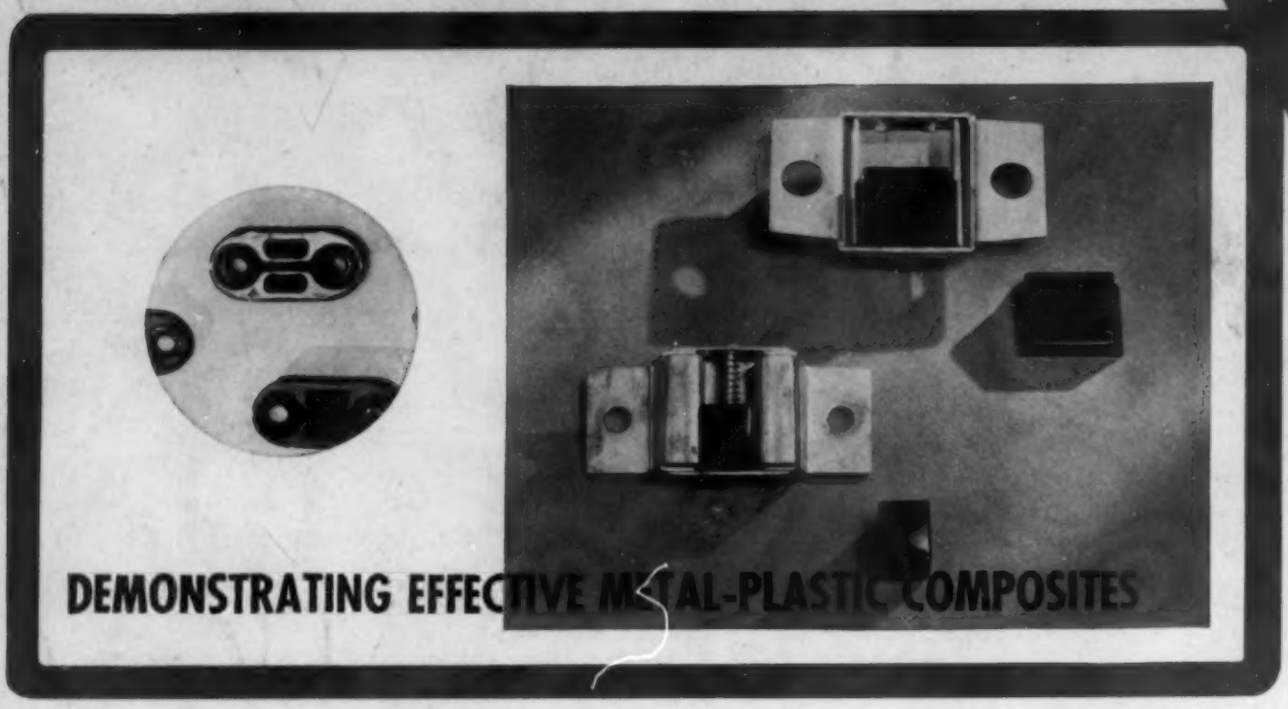
MODERN PLASTICS

FEBRUARY 1946



DEMONSTRATING EFFECTIVE METAL-PLASTIC COMPOSITES

The slamming of a door, particularly a truck door, puts a terrific strain on the materials which must stand the impact of this sharp contact. The contact wedges and take-up units illustrated are especially designed for this purpose and serve as an excellent example of the effectiveness of a metal-plastic composite.

Why Plastics?

Both the sliding wedges and the contact members were originally made from either die-cast metal or graphite-impregnated bronze. There are, however, a number of very definite advantages gained by molding the pieces of plastic. For one thing, the danger of corrosion is completely eliminated. Furthermore, wear is reduced considerably, for neither the metal nor the plastic tends to wear the other. Then there is the added feature that no finishing operations are necessary with the plastic pieces other than the removal of a slight flash or fin.

Why Phenolic Plastics?

Because of the wide range of desirable properties which are inherent characteristics of all phenolic plastics, one from this group was selected to do the job required of these take-up units. Impact strength, for example, was a prime requisite because both the sliding wedges and the contact members are subjected to terrific strain when the door is slammed. Then there is the lubrication problem. This is automatically taken care of by the inclusion of graphite as a filler material in the phenolic used. This provides self-lubrication. Noise is also reduced, for one of the unusual properties of phenolic plastics is non-reverberation.

Why Durez Phenolic Plastics?

As specialists in the development and production of phenolic plastics for the past quarter century, Durez laboratory technicians have gained the rich background necessary for maintaining the leadership of the more than 300 multi-propertied Durez phenolic molding compounds available today. Manufacturers in every field of industry are making it their practice to look to Durez phenolics for the plastics that fit their jobs.

Valuable Assistance Available

Our technicians can give you a number of examples of effective metal-plastic composites . . . examples which decisively prove that these two basic materials can be combined to make a better product . . . combined to do a job more efficiently than could either of the materials used alone.

The competent advice of experienced Durez service engineers and a wealth of proved product development data are available at all times to you and your custom molder. Durez Plastics & Chemicals, Inc., 52 Walck Road, North Tonawanda, N. Y. *Export Agents: Omni Products Corporation, 40 East 34th Street, New York 16, N. Y.*

DUREZ

PHENOLIC RESINS

- MOLDING COMPOUNDS
- INDUSTRIAL RESINS
- OIL SOLUBLE RESINS

PLASTICS THAT FIT THE JOB

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THE PERFECT CHOICE
IN TOYS FOR TOTS
Catalin's brilliant rich colors and physical properties commend the gem of plastics for use in toys—especially crib toys. Catalin is strong, and as pictured herewith and produced by Tykie Toy Co., readily fabricable into the various sizes and shapes required for assembly or stringing. Catalin's colors won't chip or peel—for Catalin is all color—clear through. Its high polish never dulls, the surface is smooth; easily wiped clean. If by chance, and the chances are good, that Catalin comes in contact with baby's mouth, mother need hold no fears because Catalin is odorless, tasteless, harmless.
Should you happen to be entertaining new ideas for toys—or anything plastic—we, at Catalin, would like to assist your thinking and planning. Inquiries invited!
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CAST RESINS • MOLDING COMPOUNDS • LIQUID RESINS

MODERN PLASTICS

AND PLASTICS

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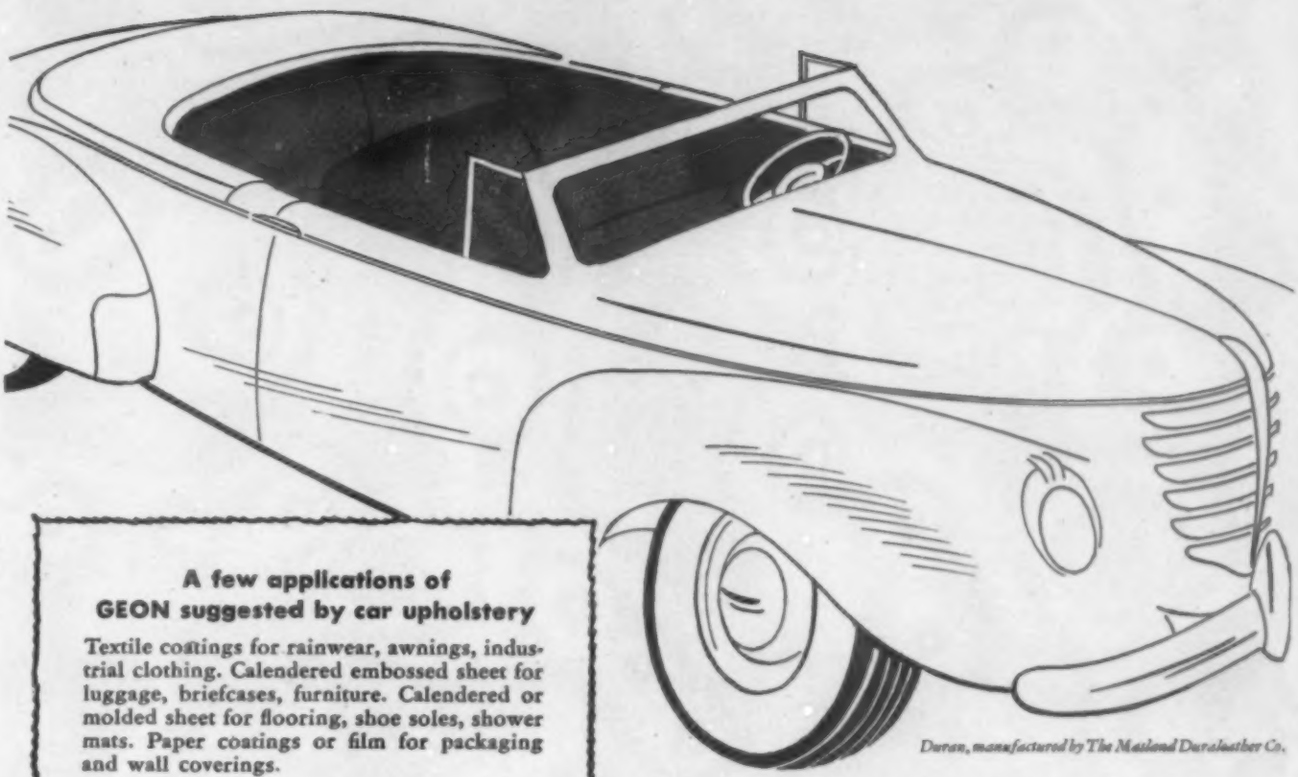
Geon ...
for converting a convertible's upholstery



Duran, manufactured by The Masland Duraleather Co.

A few applications of GEON suggested by car upholstery

Textile coatings for rainwear, awnings, industrial clothing. Calendered embossed sheet for luggage, briefcases, furniture. Calendered or molded sheet for flooring, shoe soles, shower mats. Paper coatings or film for packaging and wall coverings.

Modern, weather-resistant seating suggests uses for GEON raw materials in every industry

Convertibles of the future—as well as standard passenger models, planes, trains, and buses—will feature new materials for seating, interior trim, and tops; materials made from or treated with GEON polyvinyl resins. Performance-proved in conclusive tests, these new materials have many definite advantages over anything previously used. And the properties that make GEON superior for this purpose suggest uses in every industry and every home.

For example, upholstery material properly made from GEON will resist the effects of weather, aging, sunlight, rain, and flexing indefinitely. It won't crack or get gummy even after prolonged exposure. It's easy to clean with soap and water. It resists foods and chemicals of all kinds—even strong acids have no effect. It's mildew-proof—fungi simply can't penetrate the surface. It will wear indefinitely—won't even show signs of severe usage and scuffing. It can be brightly or delicately colored for beautiful appearance.

These and other properties may be had in any number of combinations designed to meet specific service conditions. And GEON can be processed in many different ways—injection or compression molded, calendered or cast into sheet or film, calendered or spread into thin or heavy coatings for textiles and papers of all kinds. All this means that the *established and potential applications for GEON in every field are literally limitless.* For more information about GEON raw materials please write Dept. I-2, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio.

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Case Histories from the RICHARDSON *files*

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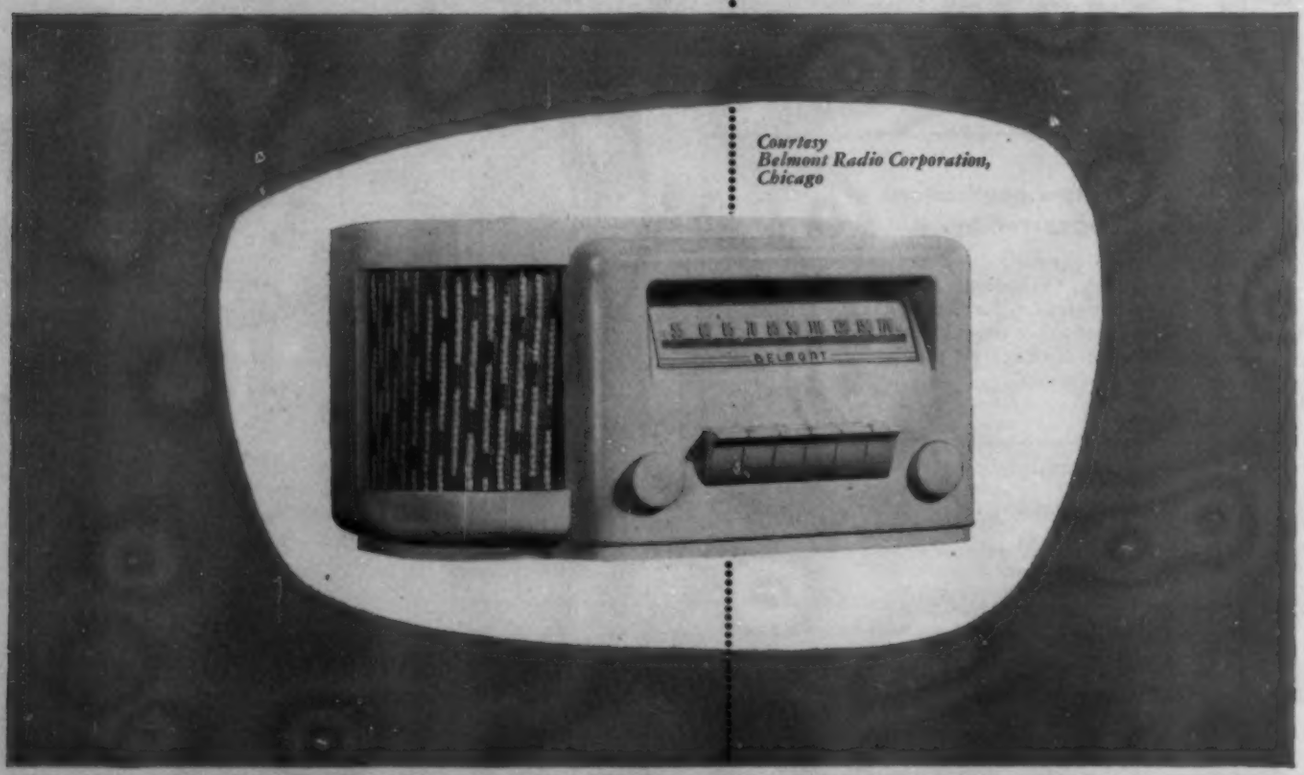
Why not consult Richardson if you are planning new products or the redesigning of present models? *Richardson Plasticians* can help you improve both the appearance and performance of your products. Write today for information.



Courtesy Belmont Radio Corporation, Chicago

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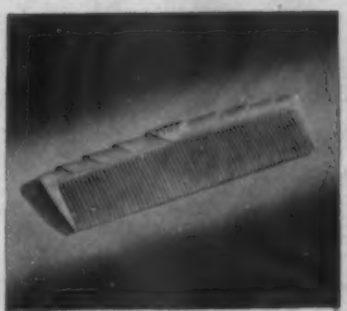
STRAP . . . WITH A SNAP

A couple of bumps on a polythene band . . . and a new idea is born



WHAT'S NEW

Combs of Du Pont nylon have many advantages. They are strong, long-lived, and can be steam-sterilized. Look for the name nylon stamped on each comb. Nylon bobby comb (above), barber combs, dressing combs are manufactured by Columbia Protektosite Co., Carlstadt, N. J.

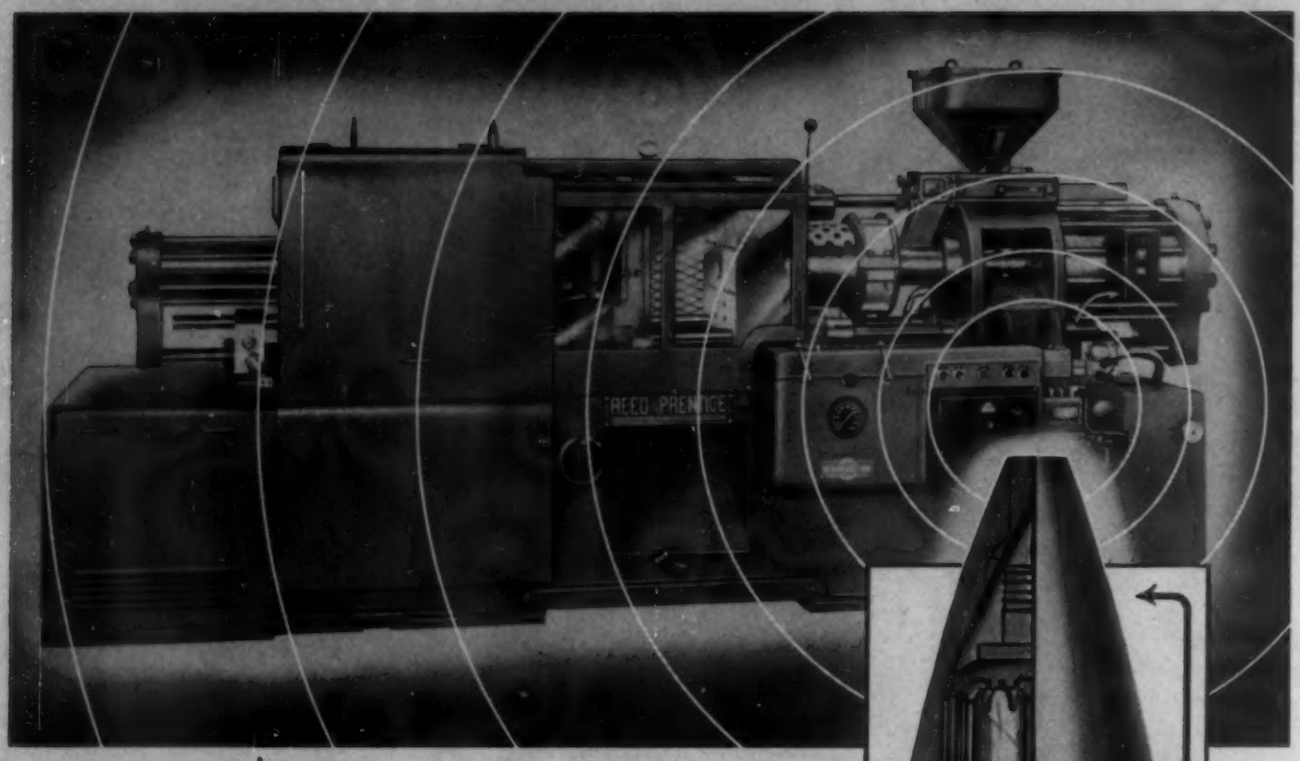
No seams, no buckles on this watch strap! Press the two snaps into place . . . and friction holds it firmly all day long. All year long, too . . . for Du Pont polythene is flexible, tough, and resistant to water and perspiration.

This new and better watch strap, made quickly and economically by injection-molding the plastic . . . is what *one* man saw in polythene. Another man saw—and produced—a polythene household tumbler. Still another wanted a heat-resistant material for zippers—found it in Du Pont nylon.

An idea for a better product is not enough. It becomes a product only when the man who conceives it finds the material with just the combination of properties it needs. Du Pont has some new plastics since the war began . . . and some of the older ones can do new things. Have you the complete list? E. I. du Pont de Nemours & Co. (Inc.), Plastics Dept., Arlington, N. J.

"Pla-Safe" watch straps *of Du Pont polythene are made in several attractive colors. Made by Pla-Safe Plastics Corp., Buffalo, N. Y.*

DU PONT
Plastics
BETTER THINGS FOR BETTER LIVING THROUGH CHEMISTRY



OUR *PART

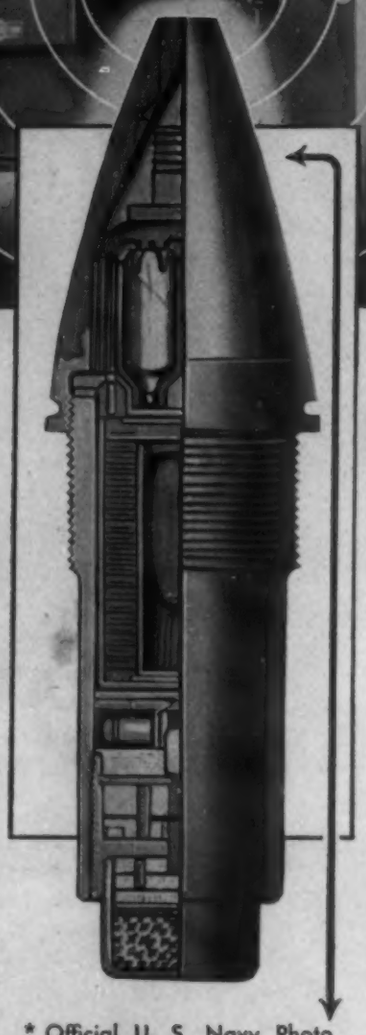
in the PROXIMITY FUSE...

The Reed-Prentice 10D-8 Oz. model Injection Molding Machine produced an important part in the manufacture of this deadly weapon (second only to the atomic bomb).

Hundreds of thousands of plastic nose pieces were turned out by molders throughout the land on Reed-Prentice injection molding machines.

The result — a devastating weapon that helped win the war; but of importance to industry — a wealth of experience in the possibilities of precision plastic molding.

Write for complete information on Reed-Prentice models — available in 22, 16, 12, 8, 6 and 4 Oz. sizes — the largest selling plastic injection molding machine in the World!



* Official U. S. Navy Photo of proximity fuse assembly, showing our "part" in the manufacture of this intricate and effective weapon.

★ ★ ★ ★ ★ ★

INJECTION MACHINES

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VIMLITE*

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A Division of

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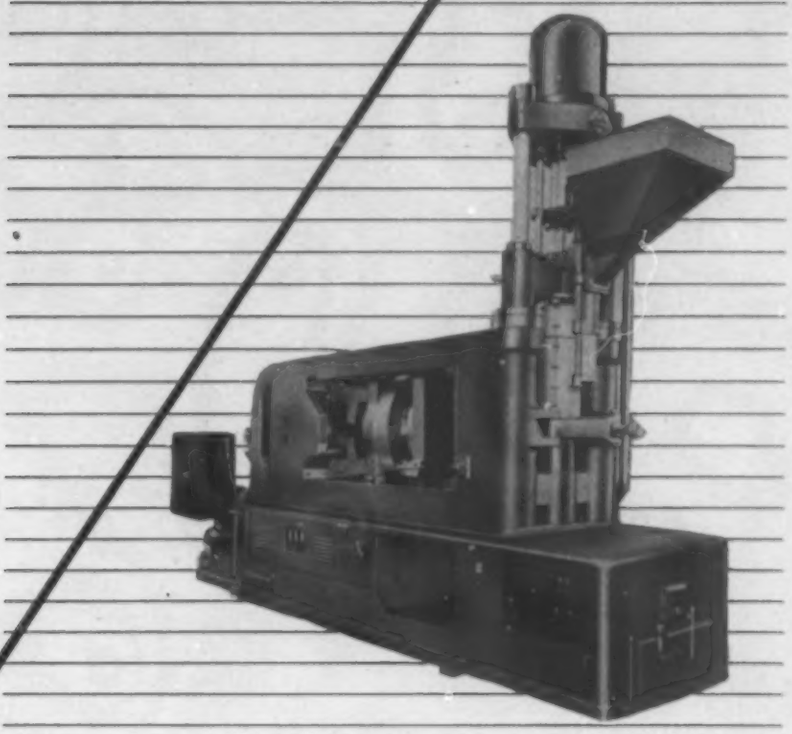
INJECTION MOLDING



TAKES A STEP FORWARD

The new Lester is designed to make injection molding a faster, simpler, more economical process. Whether you are a commercial molder or a manufacturer operating your own molding department, you will profit from the new and exclusive features which have been engineered into this superb machine. Leading molders of the United States have been testing these new Lester designs for months, and have pronounced them distinctly superior to those of previously built equipment. Why not get full information on the new Lester so that you, too, may know its advantages?

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Above map does not attempt to show all products available in the various states

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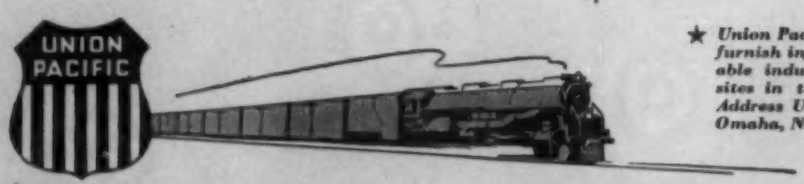
This vast territory might well be called both the treasure-chest and bread-basket of the nation. In addition to its great wealth of industrial raw materials, a boundless supply of foodstuffs is provided by its farms, ranches, orchards and fisheries.

For example, in Nebraska, Kansas, the Pacific Northwest, and in practically all other regions in Union Pacific territory, there is a large supply of raw materials used by the plastics industry. Union Pacific has the equipment and personnel to meet all the requirements of shippers in those regions.

These thirteen western states served by the railroad are ripe for postwar expansion. They have the materials, facilities and space.

Union Pacific will continue to play its part in the future progress of this western territory by providing unexcelled freight and passenger transportation over its Strategic Middle Route.

Be Specific— say "Union Pacific"



★ *Union Pacific will, upon request, furnish information about available industrial and mercantile sites in the territory it serves. Address Union Pacific Railroad, Omaha, Nebraska.*

The Progressive

UNION PACIFIC RAILROAD

The Strategic Middle Route

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BIRDSBORO

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THIS eye-appealing stove dial illustrated above is a small item. There's no doubt about that. Its importance to the assembled unit, however, is far from being small. It has a vital job to perform and it must perform it well or the consumer will be dissatisfied with the entire stove. Furthermore, its design must be attractive... must blend with the modern style of the complete unit. Notice the inclusion of a metal piece —making it even more attractive.

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Unfortunately, the current shortage of plastic materials limits our operations considerably. However, the future looks bright and now is the time to plan for it. Norton Laboratories, Inc., Lockport, N. Y. *Sales Offices: 347 Fifth Ave., New York City—9 South Clinton St., Chicago.*

NORTON *Laboratories, Inc.*

COMPRESSION AND INJECTION MOLDING

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- How Plastics are converted into useful products; equipment required.
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- Phenolic Plastics: Classification of fillers, wood-flour filled compounds; impact resisting and mineral filled phenolic compounds; special grades of phenolic compositions.
- Laminated phenolic plastics, their manufacture; reinforcing materials, such as glass, wool rayon, and perforated metals.
- Urea resins, characteristics, formation, effect of filler, their pastel, translucent and electrical characteristics, moisture influences, chemical properties, surface coatings, etc.
- Cellulose Plastics: Cellulose nitrate and acetate; how made and used, forms available, with comparison of cellulose acetate and nitrate with practical applications.
- Cellulose Plastics: Cellulose acetate butyrate and properties, use for upholstering materials and continuous filaments; rayon.
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- Polyvinyl chloride-acetate, its applications.
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- Electronic preheating methods.
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- Forming and drawing plastics materials, how to heat and develop pressure, bending and shaping over other materials, etc.
- Casting plastics; which plastics are cast; molds for plastics.
- Slush molding and its various applications.
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Plastics
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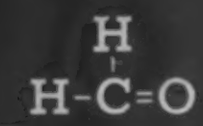

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Plastic Pre-form in Heatronics Applicator for Radiofrequency Pre-heating.

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Kurz-Kasch

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Adamson United Calenders are expressly designed for extremely close tolerance in the production of plastic film, or for the coating of fabric with rubber or plastic. Among their many features are:

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- Roll diameter and lengths are selected for each particular job. Various roll combinations are available.

Write for complete technical data, or consult our engineers concerning special rubber or plastics machinery or processes.

* **Adamson United is staffed to engineer and furnish complete calendering process systems for either Rubber or Plastics, including all accessory equipment, such as**

FABRIC DRYING
EXPANDER ROLLS
GUIDING DEVICES
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WIND-UP AND LET-OFF STANDS

with associated coordinated drives.

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DISTRICT SALES OFFICES:
C. H. Armstrong, Manager, Bloomfield Bank & Trust Building, Bloomfield, N. J. Telephone: Bloomfield 2-4143
C. M. Baldwin, Manager, 140 South Clarke Street, Chicago 3, Illinois, Telephone: Central 1353

Subsidiary of UNITED ENGINEERING AND FOUNDRY COMPANY
Plants at PITTSBURGH · VANDERGRIFT · NEW CASTLE · YOUNGSTOWN · CANTON

The Latch String is out again

One of the things that we liked least about the war, was the fact that it cramped our usual Northern hospitality.

To begin with, it's been a long time since we have been able to invite our customers and friends out to visit our plant. Government restrictions, you understand.

Now that we are back to peace time production, we would like to get on the record again with our open invitation to come out and see us some time—any time.

The four stars on our Army-Navy "E" may indicate the volume and type of war production we turned out. One of the good results is an expanded more efficient plant—a better set-up than the one we had when war was declared.

In addition, we have learned a lot during the war years. We had to keep our tolerances close, our rejects at a minimum. All of these are on the credit side of the ledger, all are available to present and future customers. May we repeat the invitation: Come out and see us and we will show you what we are talking about.

The latch string is always out on a "Ready Reference For Plastics." You may have a free copy of this introduction to plastics merely by writing a note on your letterhead.

BMCO

ARMY E NAVY

BOONTON MOLDING COMPANY

MOLDERS OF PLASTICS · PHENOLICS · UREAS · THERMO PLASTICS

BOONTON · NEW JERSEY · Tel. Boonton 8-2020

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Chanin Bldg. 122 East 42nd Street, New York 17, N. Y. MUrray Hill 6-8540

the plastic

THAT OPENS A WOMAN'S PURSE

Glance along any cosmetics or jewelry counter. You'll find that women today are quick to respond to the finer things in plastics. And that means not only "dress-up" items but also articles of workaday life, such as household appliances, tools, kitchen utensils and an increasing host of products to which plastics contribute.

That's the reason, when the discerning woman opens her purse to buy, she's more and more likely to select goods made of Styron, the nation's No. 1 plastic.

Produced by Dow and improved through continuing research, Styron conveys new ideas of solid value and luxury. Its surface beauty and sparkling colors, its strength, its lightness combine to give new zest to many products. But the intelligent woman is interested, too, in getting value for her money. So are the makers of a lengthening list of plastic goods. And Dow's position as a producer of basic materials enables manufacturers to provide an increasing variety of better goods at low cost.

This means a wider use of Dow plastics in new and greater ways. Styron and other plastics from Dow can be depended upon to bring a full measure of beauty and serviceability to home appliances, automobiles, even building—to countless adjuncts to more pleasant living.

THE DOW CHEMICAL COMPANY
MIDLAND, MICHIGAN

New York • Boston • Philadelphia • Washington • Cleveland
Detroit • Chicago • St. Louis • Houston • San Francisco
Los Angeles • Seattle

STYRON

THE NATION'S NO. 1 PLASTIC

Styron is Dow Polystyrene, a top-rate material for many manufacturing purposes. Other Dow plastics: Styraloy for electrical insulation; Saran for colorful fabrics that can be cleaned with a damp cloth or for corrosion-resistant pipe and tubing; Saran Film and Ethocel Sheeting for better packaging; Ethocel for durable molded products; and materials for coatings and finishes.

Dow Plastics include: *Styron, Styraloy, Saran, Saran Film, Ethocel and Ethocel Sheeting*

DOW

PLASTICS

Beauty and Utility

IN PLASTICS *and* METALS

Important to all designers is the fact that plastics, metals, and plastic-metal combinations are being produced entirely under one roof by the Bay Manufacturing Division of Auto-Lite. Such examples as this Fifth Avenue Medallion, a finely designed plastic casting mounted on a chrome-plated and decorative bezel . . . the vinylite plastic grommet and nipples (vinylite does not require the heavy walls of rubber products) . . . the etched enamel-filled high polished chrome escutcheon . . . typify fine Auto-Lite craftsmanship.

THE ELECTRIC AUTO-LITE COMPANY

Detroit 2, Mich. — Bay Manufacturing Division — Bay City, Mich.

UNDER ONE BIG ROOF AT . . .

Auto-Lite

Tune in the Auto-Lite Radio Show Starring Dick Haymes Every Saturday Night, 8:00 P.M.—E.S.T. on CBS

BUY MORE BONDS

LEA

Specialists in Cutting and Buffing Methods and Materials

IN WAR

And for plastic war implements with which Lea Technicians have lent a helping hand. Bomber Noses made of PLEXIGLAS were much in the public eye.

IN PEACE

No better examples of the results of Lea service in connection with peace time merchandise can be found than in this CATALIN Brush Handle and these CRYSTALITE Cosmetic Containers.

LEA Technicians, skilled in the art of finishing surfaces of all kinds, have been very helpful to those working with plastics. Today, their service is doubly valuable in helping manufacturers to: *(1)* effectively meet more rigid specifications; *(2)* do the work faster; and *(3)* do it more economically.

Write us about your problem of cutting or buffing or any other step having to do with the finish of your plastic articles. We have the experience and materials with which to help you.

THE LEA MANUFACTURING CO.

Burring, Buffing and Polishing . . . Manufacturers and Specialists in the development of Production Methods and Compositions

Waterbury 86, Conn.

Insure THE CONSUMER ACCEPTANCE OF YOUR PLASTIC PRODUCTS WITH THIS

QUALITY CONTROL Plan

Plastic products, more than any others, require proof of quality . . . for Plastics are comparatively new to the consumer.

Give your Plastics quality backing that will automatically win consumer acceptance . . . enroll them in the Certified Merchandise Group of the United States Testing Company, Inc.

This is a group of nationally famous products that are tested by us, Certified, and then check-tested continuously on a steady program basis. Only products that meet . . . and continue to meet . . . our standards of quality, construction, and serviceability are Certified. They are awarded the nationally famous Seal of Quality . . . recognized by women's clubs, consumer groups, and shoppers everywhere . . . for use on labels, hang-tags, and in advertising.

Backed by this story of scientific Testing and Certification . . . and identified by the Seal of Quality . . . your Plastic products will carry with them an assurance of consumer satisfaction available no other way.

Write for complete details

UNITED STATES TESTING COMPANY, INC.

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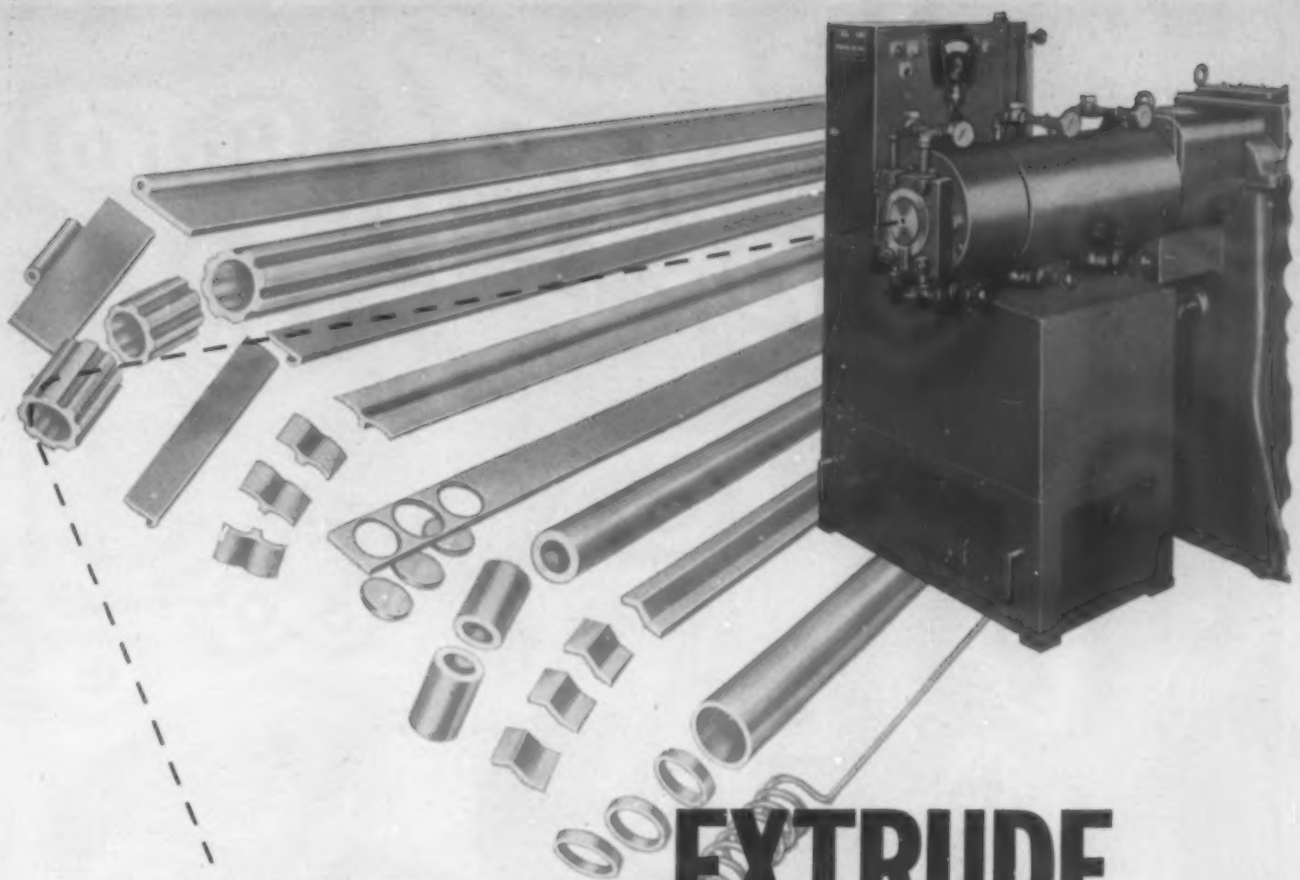


Every part you can EXTRUDE

can mean *better, faster, lower-cost* production of your product

WHEN you engineer your product for production, it will pay you to plan to *extrude* as many of the plastic parts as possible.

Here's why:

Extrusion is a *continuous* process, making possible a high rate of production with maximum uniformity and a minimum of machine downtime. Operators require no special skill.

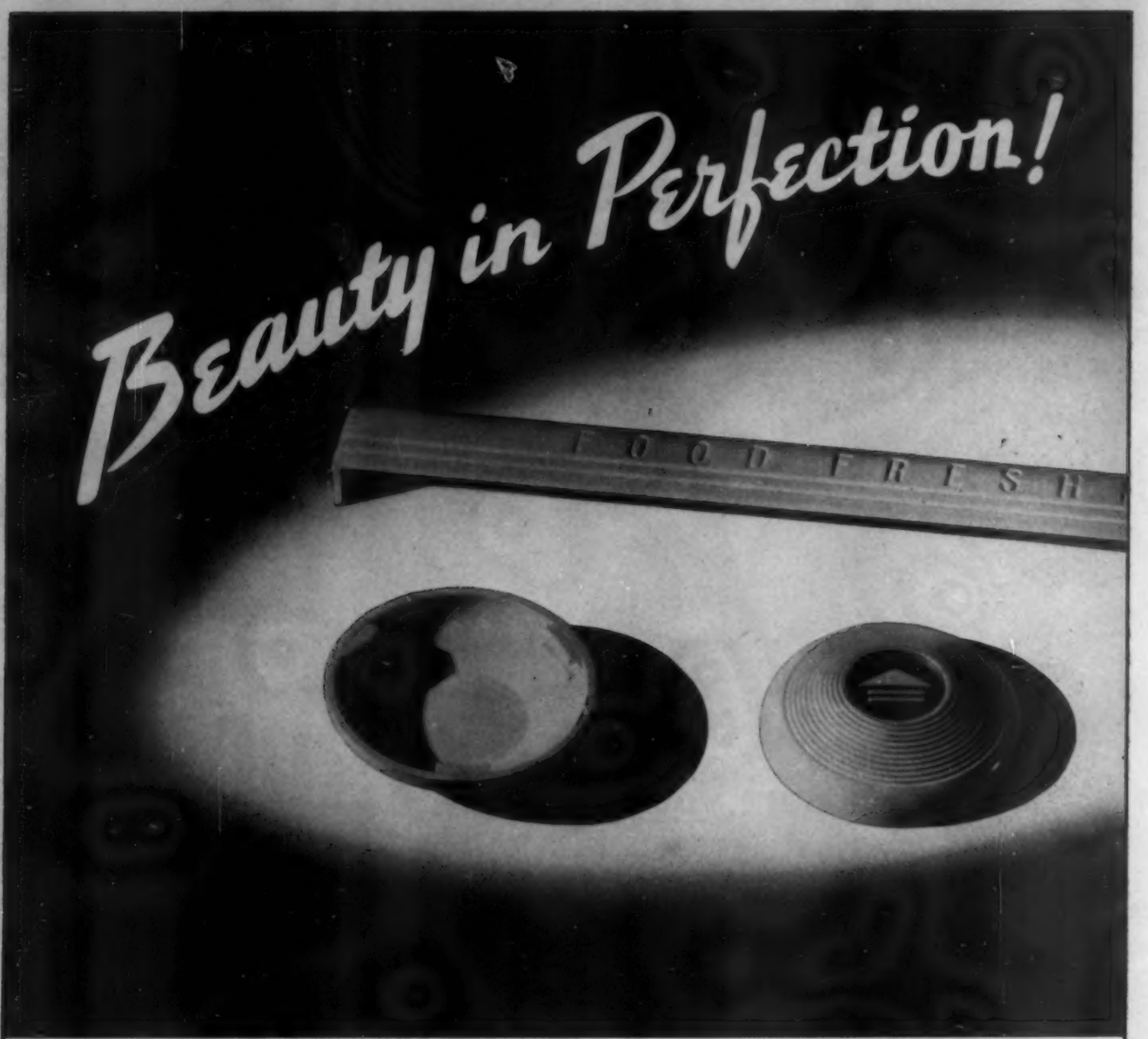
Infinite varieties of shapes may be produced . . . round, angular, solid, tubular, or a combination of such shapes. The extrusion may be cut, stamped, machined, pressed, punched, or bent, to produce another vast range of shapes.

Product design is improved, sales appeal heightened. Extrusions for trim or functional parts add smartness, style, beauty, and often better performance.

So, don't overlook this modern, fast-growing method of plastics production in the manufacture of your product. Plan *now* to use plastics extrusions wherever practical. How to learn where the extrusion principle may be most effectively applied? Our new catalog of America's most complete line of plastics extrusion machinery will give you a clear picture of the process and its possibilities. Write for Catalog M-2 today.

NATIONAL RUBBER MACHINERY CO.
General Offices: Akron 11, O.

Plastics
MACHINERY DIVISION



Complete facilities from the idea to the finished product, suited to your needs, whether your product is functional or decorative.

INJECTION MOLDING
MINCOR
YOUR PLASTICS DEPARTMENT

For full information, write

MINNESOTA PLASTICS CORP.

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COLORFUL

ANNOUNCING! NEW SALES APPEAL

FOR YOUR PRODUCT!

SHERWIN-WILLIAMS

DIMENSO

Trade Mark Reg. U. S. Pat. Off.

Revolutionary New Three Dimension—Two Color Finishes with a Single Spray Operation!

Give your product a startlingly beautiful finish with hammered metallic or diffused multi-color effects . . . in one spray operation! A finish of highest quality in hundreds of color combinations to make your product stand out and SELL.

New in effect, DIMENSO is practical in use . . . can be applied with standard spray equipment and the patented DIMENSO gun. Background color and dimensional color are sprayed simultaneously through one nozzle producing a smooth, uniform finish.

DIMENSO is a synthetic finish of highest quality—fits every baking schedule—bakes to a crack-free finish that resists wear, cleans easily. It's economical . . . two colors applied in one operation, only one baking.

Exclusive Registered Dimenso Finishes

Sherwin-Williams will work with you to develop your DIMENSO combination. That combination will be registered and be yours alone. Call for a demonstration today.

FREE!

DIMENSO BOOKLET...

A request on your business letterhead will bring this interesting booklet describing DIMENSO and containing actual finish samples.

SHERWIN-WILLIAMS INDUSTRIAL FINISHES

Why Speed Nuts are *First* with all Five

NOTHING LOCKS LIKE A SPEED NUT

TWO distinct forces are exerted on the screw, as a SPEED NUT is tightened.
First, a compensating thread lock, as the two arched prongs move inward to lock against the root of the screw thread. These free-acting prongs compensate for screw thread tolerance variations.
Second, a self-energizing spring lock, created by the compression of the arch in both the prongs and base. The combined forces of the thread lock and spring lock definitely prevent vibration loosening.

FIRST WITH ENGINEERING **because SPEED NUTS simplify design and are, or can be produced to meet any assembly requirements.**

FIRST WITH MANAGEMENT **because SPEED NUTS are time-tested, vibration-proof fasteners that improve the quality, and prolong the life of the finished product.**

FIRST WITH PURCHASING **because SPEED NUTS lower inventory costs, reduce stocking problems, and are DELIVERED on time. Production and service facilities are unlimited.**

FIRST WITH PRODUCTION **because SPEED NUTS eliminate extra handling of parts, are applied faster and easier, and compensate for a wider range of tolerances.**

FIRST WITH TIME STUDY AND COST **because SPEED NUTS slash total net assembly costs to a fraction of other assembly methods.**
Investigation will show that SPEED NUTS should be YOUR first choice, too. Write today.

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Speed Nuts* PATENTED

* Trade Mark Reg. U. S. Pat. Off.

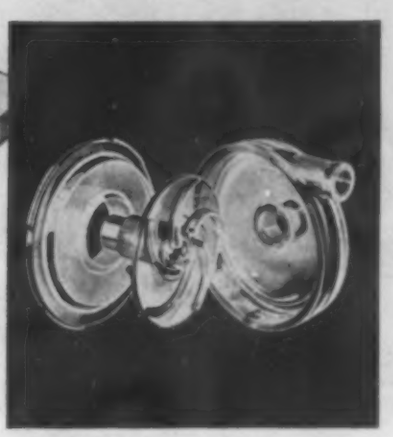
FASTEST THING IN FASTENINGS...OVER 2000 SHAPES AND SIZES

GLASS

makes these products better

VACUUM TYPE COFFEE MAKER BOWLS—High heat resistance, good mechanical strength, attractive appearance, no contamination.

TRANSMITTING TUBE—Contains ten different glass parts each with properties important to its particular function, with the emphasis on electrical properties.



PUMP PARTS—Corrosion resistance, heat resistance, can be finished to close tolerances.

MIXING BOWLS—Attractive appearance, easy to clean and keep clean, rugged, uniform color and quality.

Corrosion resistance, transparency, heat resistance and permanence of color, finish and dimensions are some of the properties which glass offers in unique and useful combinations. Corning can help you take advantage of all the inherent valuable properties of glass in developing new products and in redesigning.

RESEARCH IN GLASS

Corning has developed more than fifty thousand different glass formulae each designed to provide a balance of properties which will meet the requirements of specific applications. These glasses possess valuable properties throughout a wide range of values and in many combinations. Corning can show you the glass best suited for your requirements or if necessary develop a special formula.

CORRECT GLASS DESIGN

The Product Engineering Department at Corning has on file detailed drawings of more than forty thousand different glass products, each a stepping stone to better design practice. This vast knowledge and experience accumulated over the years provide valuable data on which to base new designs which will incorporate all the advantages of glass to the greatest degree. This department will be glad to assist you in your design problems.

PRODUCTION FACILITIES

The versatile production facilities of Corning, as well as the "know-how" and experience of the men engaged in manufacturing, assure economical production of quality glassware in almost any quantity desired. Glass can be pressed, blown or drawn either by hand methods for small quantities or by high-speed automatic machinery. Precision tolerances can be secured by carefully controlled finishing operations.

Many manufacturers have found that the use of glass in their products has lowered manufacturing costs, speeded up production and increased sales. Corning will be glad to show you how glass can be incorporated in your new products or in the redesign of your present products. Your inquiry will receive prompt attention. Write to the Industrial Sales Department MP2

CORNING GLASS WORKS
CORNING, N. Y.

CORNING *means* Research in Glass

INDUSTRIAL

"PYREX" and "CORNING" ARE REGISTERED TRADE MARKS AND INDICATE MANUFACTURE BY CORNING GLASS WORKS, CORNING, N.Y.

GLASS by CORNING

INDUSTRIAL SALES DEPT., MP2
Corning Glass Works, Corning, New York

Please send me a copy of your Bulletin IZ-1—
"*Industrial Glass by Corning.*"

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SPECIFICITY, *precise adjustment to one specific application*, is the distinguishing characteristic of Interlake Resins.

THEY are made—not to do several jobs—but to do *one job well*—and to keep on doing it *uniformly!*

They are called *specification resins* because Interlake, in each case, functionally engineers one resin to the specific requirements and conditions of *your* application—tests it on *your* job, in *your* plant—then stabilizes its production for continuous uniformity in performance.

That is why important industrial users come to Interlake when contemplating new resin applications—or—when a presently used resin is *not* fully meeting the functional and production requirements of a particular job.

WHAT TO DO IF YOU HAVE EITHER A RESIN OR MOLDING PROBLEM...*Call on*

for MOLD-ABILITY in PLASTICS

The largest, the smallest and the most intricate pieces ever molded have been molded of Makalot Thermosetting Compounds.

WHATEVER properties have been required of molded materials—and, in not a few instances, properties desired *but never previously thought possible*—have been obtained by molders using Makalot Compounds.

Interlake has low loss Makalot Compounds for high frequency applications, non-cracking for molding around inserts, non-shrinking, heat resistant, general purpose, super-impact, X-ray or sweat resistant, or with brilliant surface lustre—and—*every one* of these compounds has been proved in successful use by some of the country's foremost molders.

There is a Makalot Compound for every molding job.

INTERLAKE CHEMICAL
Corporation
• PRODUCTS FROM COAL •

Interlake will supply a Specification Resin or a Makalot Compound *exactly suited to your application.* Write Interlake Chemical Corporation, Plastics Division, 1911 Union Commerce Building, Cleveland 14, Ohio.

TYBOND

What TYBOND offers PLASTIC PARTS BUYERS

MOLD MAKING • Molds are designed for rapid production, long life, uniform molding and curing.

MOLDING • TYBOND selects molding materials to meet exact specifications. TYBOND molders are men of exceptional plastic skill, know how to regulate curing for optimum polymerization.

MACHINING — FINISHING • Complete equipment at TYBOND for all finishing operations—buffing, polishing, drilling, tapping, counter-sinking, etc. Everything under one roof.

OPERATIONS CONTROL • *To do the job right the first time,* TYBOND continually inspects, tests, analyzes—as the job progresses. TYBOND's fussiness over trifles keeps TYBOND-made plastic parts consistently up to specifications.

ABOVE all else TYBOND offers *precision on a low cost rapid production basis.*

We proved that for the Armed Forces when we met specifications and delivery schedules that others thought impossible of attainment.

We're proving it again for industry. Manufacturers who ordered TYBOND plastics for their War contracts have awarded us their peacetime business. They want the same TYBOND precision and dependable schedules for their own products. They're getting both.

Since we have our own mold making facilities, we usually get into production faster. Initial deliveries come through sooner. Your inquiry will receive prompt, careful consideration.

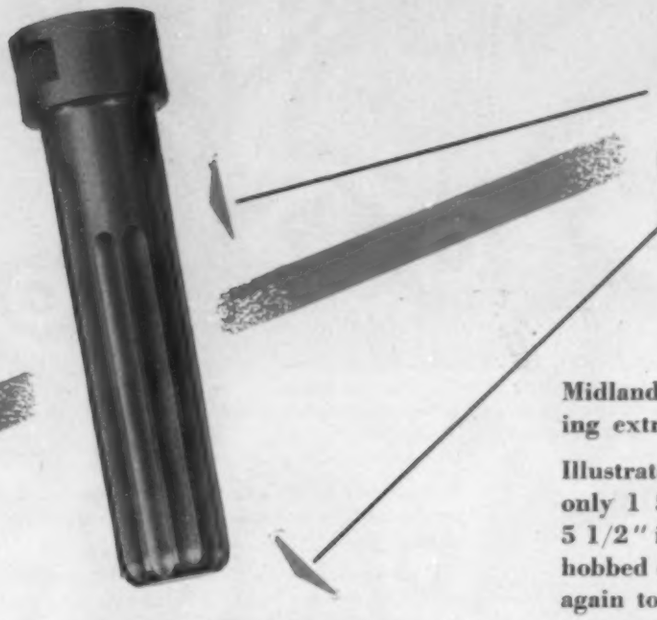
TYBOND

Molded Plastics Parts

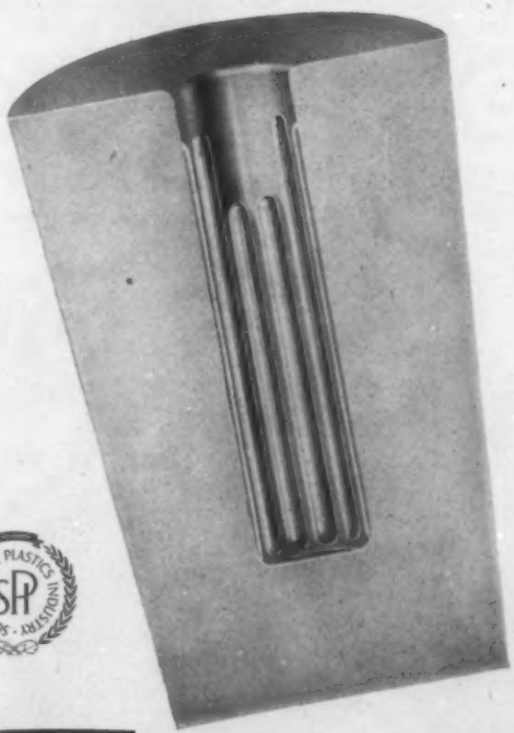
TYBOND PRODUCTS COMPANY • 2435 N. WESTERN AVE., CHICAGO

"SMALL ENOUGH TO GIVE YOU PERSONALIZED SERVICE, LARGE ENOUGH TO PRODUCE IN THE MILLIONS."

$5\frac{1}{2}$" DEEP... ONLY $1\frac{5}{16}$" IN DIAMETER



Hobbed Cavities *by* Midland



Midland has developed special skill in perfecting extra deep and intricate hobbed cavities.

Illustrated to the left is a Midland hob that is only 1 5/16" in diameter, yet it was pushed 5 1/2" into a steel die block to form a perfect hobbed cavity. This hob can be used again and again to duplicate the original hobbed cavity at a small fraction of the cost of machining and hand finishing.

Whether you are a custom molder, a manufacturer operating a molding department, or a purchaser of molded parts, there is some phase of our facilities and knowledge that should be of interest or help to you.

MIDLAND OFFERS YOU TWO VALUABLE BOOKS, *WRITE FOR THEM!*

Here is a very practical heat treating treatise that will help you get the best performance from Hobbed Cavities by Midland.

This book gives complete information about Midland organization, experience and facilities.

SOCIETY OF THE PLASTICS INDUSTRY · SPI

MIDLAND DIE AND ENGRAVING COMPANY

1800 W. BERENICE AVENUE · · · CHICAGO 13, ILLINOIS

Makers of Plastic Molds • Die Cast Molds • Engraved Dies • Steel Stamps • Hobbings • Pantograph Engraving

IN RESINS! Glycerine is an important component in the making of alkyd resins, used for automotive finishes and for finishes on refrigerators, stoves, and other home appliances, because it is efficient and high-boiling, and offers complete availability of all three of its hydroxyl groups. Pictured above is a depth gauge used to measure the thickness of paint.

What's News In Chemistry?

—Glycerine!

GLYCERINE, known for generations to chemists, is still something new, something exciting in its possibilities, both for products for human consumption and for use in industry.

Glycerine is chemically stable under ordinary conditions, and by proper choice of conditions many other useful chemicals can be made from it.

For instance, glycerine is an important component of alkyd resins, used in making protective coatings and in processing textiles. It is used in making ester gum, an important constituent of varnishes.

It is one of the basic materials used in making monoglycerides, employed in shortening and margarines. And it is used in making polyglycerols, which are higher-boiling, more viscous glycerine-like substances useful in the manufacture of some of the resins.

Because of its many advantages, so many manufacturers desire glycerine for so many purposes that this versatile material is more in demand than ever before.

GLYCERINE PRODUCERS' ASSOCIATION

295 Madison Avenue, New York 17, N. Y., Dept. J-15, Research Headquarters, Chicago, Ill.

IN DRUGS AND COSMETICS! Glycerine has been a known and trusted standby for generations in the making of pharmaceuticals. It is also a material that offers ever-new possibilities.

IN FOODS AND CONFECTIONS! U.S.P. glycerine, pure, sweet, and wholesome, is a valuable ingredient in itself—and also offers advantages in the derivatives that can be made from it.

IN TEXTILES! Glycerine is used in dye baths, printing pastes, and spray-dye solutions employed in coloring and printing many types of textiles. The use of glycerine-derived alkyd resins in the textile field is growing.

• Every day new forms and applications are being found for Firestone's wonder material—*Velon*.

As yarn it can be extruded in multifilament for products ranging from gossamer fabrics to heavy brocades. *Velon* monofilament makes upholstery fabrics for home or commercial seating: drapes, wall-trim, luggage, hats, belts, shoes.

As screening *Velon* cannot corrode or rust, and is impervious to dirt, salt spray, moisture, acids and alkalis. Only one-fifth the weight of same gauge metal screening, it resists up to six times more impact without denting or bulging. And *Velon* can be tinted to blend with interior and exterior color schemes.

As film *Velon* can be made in almost any thickness and tensile strength. It can have very high (or where desirable very low) tear resistance, be elastic, or capable of great elongation with practically no recovery. As packaging, *Velon* film can embody a high degree of moisture-vapor resistance, or permit breathing. It can be transparent, translucent or opaque, clear or colored. *Velon* film's applications range from protective packaging to shower curtains, rainwear, book cover stock, lampshades.

Firestone engineers are available for consultation. They will "tailor" *Velon* to your specific needs—or advise what *Velon* already available best suits your purpose. Write Firestone, Akron for full information.

Listen to the Voice of Firestone Monday Evenings over NBC

*TRADE MARK

MADE BY Firestone

BEST TODAY . . . STILL BETTER TOMORROW

Cut down on

MAINTENANCE Shut-downs

WITH

ROLLWAY

RIGHT-ANGLE LOADING

Now—when you are sweating out production to catch up with peacetime demand—when every shut-down means lost marketing opportunity as well as costly labor and machines standing idle—give Rollway *right-angle loading* a chance to prove what it can do for you in the way of preventive maintenance.

Rollway Right-Angle Roller Bearings will help your machines to run longer under heavier loads . . . with lower maintenance cost . . . and low bearing-replacement costs. That's because Rollway *right-angle loading* splits all compound loads into the two simple components of pure radial and pure thrust . . . carries each of these components on a separate bearing assembly at *right angles to the roller axis*. It reduces the unit loading on rollers and bearings. Insures lower starting and running torque. Eliminates all resultants from oblique loads, all piling up of thrust and radial loads on the same bearings. That's why you get longer periods of precision operation, with fewer shut-downs for service or replacement.

● **Send us a print or detailed description of your bearing needs for free bearing analysis and recommendation. No charge. No obligation. S.A.E., and American Standard metric dimensions and tolerances are available for most applications, assuring quick supply and low replacement costs.**

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ROLLWAY CYLINDRICAL ROLLER BEARINGS

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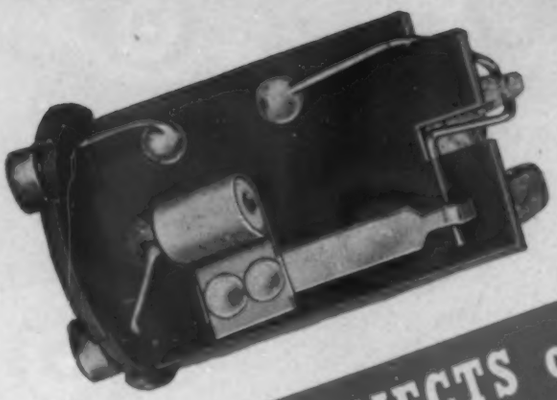
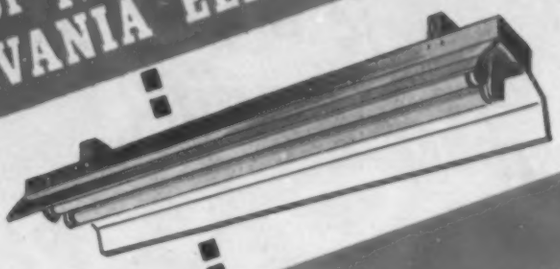
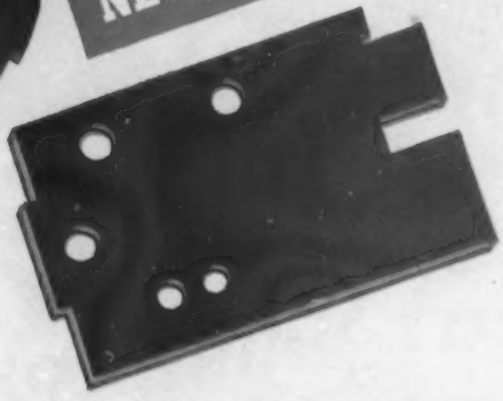


FEWER REJECTS of precision-tolerance parts AT SYLVANIA ELECTRIC



with TAYLOR NEW, COLD-PUNCHING PHENOL FIBRE



COP 40 starter switches in fluorescent lights produced by Sylvania Electric Products, Inc., call for precision tolerances. Taylor makes them by the thousands . . . and to perfection.

Wherever Laminated Plastics are called for, Taylor Fibre engineering skill is equal to the task of producing any fabricated part—no matter how complicated the design or how close the tolerances. Such parts can be mass-produced and speedily delivered. With Taylor fabricated parts, you can be assured of uninterrupted production, for our own inspection eliminates rejects in advance.

Sylvania Electric's experience is duplicated in hundreds of other plants where production engineers have discovered that "no one can turn out accurate parts like Taylor." If you fabricate your own parts, you will have better success if you start with Taylor sheets, rods, or tubes, particularly the newly developed, cold-punching, paper base Phenol Fibre that handles satisfactorily in any kind of punch and die.

Tell us what you're interested in and we'll gladly send you completely descriptive folders or technical data concerning any Vulcanized Fibre or Phenol Fibre product. Our Engineering Department is available for free consultation.

TAYLOR FIBRE COMPANY

LAMINATED PLASTICS: PHENOL FIBRE • VULCANIZED FIBRE—Sheets, Rods, Tubes, and Fabricated Parts

NORRISTOWN, PENNSYLVANIA **Offices in Principal Cities** **LA VERNE, CALIFORNIA**

"What! – you stuck those ceramic discs to rubber matting?"

"SURE . . . Pliobond* BONDS ANYTHING TO ANYTHING!"

Yes, throughout the industrial world Pliobond is proving to be the *one agent* that firmly joins *any* materials : : . like or unlike . . . solid or porous.

For instance, ceramic discs can even be bonded to rubber so that they will withstand a peel test of 37# p.s.i. Vibration or flexing of the rubber will not disturb the bond . . . because it is *pliable*.

There are no fussy mixtures . . . precise weighing . . . critical temperatures when you use Pliobond, because it is a *one*-part bonding agent. It can be brushed, sprayed, spread or roller coated.

Write us for specific technical information, directed to your own adhesive requirements.

UNITED STATES PLYWOOD CORPORATION . . . *Exclusive Distributors*

Industrial Adhesives Division: 55 West 44th Street, New York 18, N. Y. • Branches in Principal Cities, including Toronto, Canada

PLIOBOND is a product of* THE GOODYEAR TIRE & RUBBER COMPANY • *Trademark registered, The Goodyear Tire & Rubber Company

Baby Book Bank, molded of acetate for Banthrico, Chicago

Something to Bank on

This bank can teach you a profitable lesson in plastics. While it was made to teach a child one of the dependable virtues, it also tells you about one of the most dependable virtues of the Elmer E. Mills Corporation . . . our imagineering* versatility. It is proof of the painstaking care and attention we give to injection molding and extrusion jobs from the simple to the highly complex.

You can always bank on this fact: A product molded by the Elmer E. Mills Corporation will be a brilliant example of the plastic molder's craftsmanship and scientific ingenuity.

Bring your next molding job to us. You will be more than pleased with the result.

*Imagination and Engineering Skill

Write on your letterhead for the new Injection Molded and Extruded Plastics Catalog. Or, for detailed information about [redacted]*, pipe, tubing and fittings, write for circulars containing data and illustrations.

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PLASTIC COATED MATERIALS
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Resproid
is our trade name, covering products made with plastics—such as Plastic Coated Fabrics • Plastic Films • Extruded Plastics

Respro is compounding and processing the new synthetic resins to meet your demands for coated materials and unsupported free films.

These Resproid plastic materials are pliable, resistant to abrasion, scuffing and cracking.

Available in patent and grain finishes to replace leather in handbags, luggage, upholstery and shoe linings.

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In extruded rods, tubes and profiles for industry.

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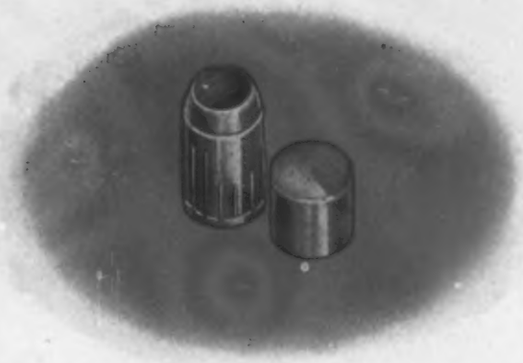

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For many years we have specialized in making plastic closures.

Now the automatic machines that mold these closures make millions and millions of small plastic items to fill a vast variety of needs.

Our extensive research, our past war assignments, our long manufacturing experiences—mean that these thermo-setting plastic units are turned out with the utmost efficiency, speed and economy!

If you need any type of small plastic unit, we suggest you consult our expert designers.

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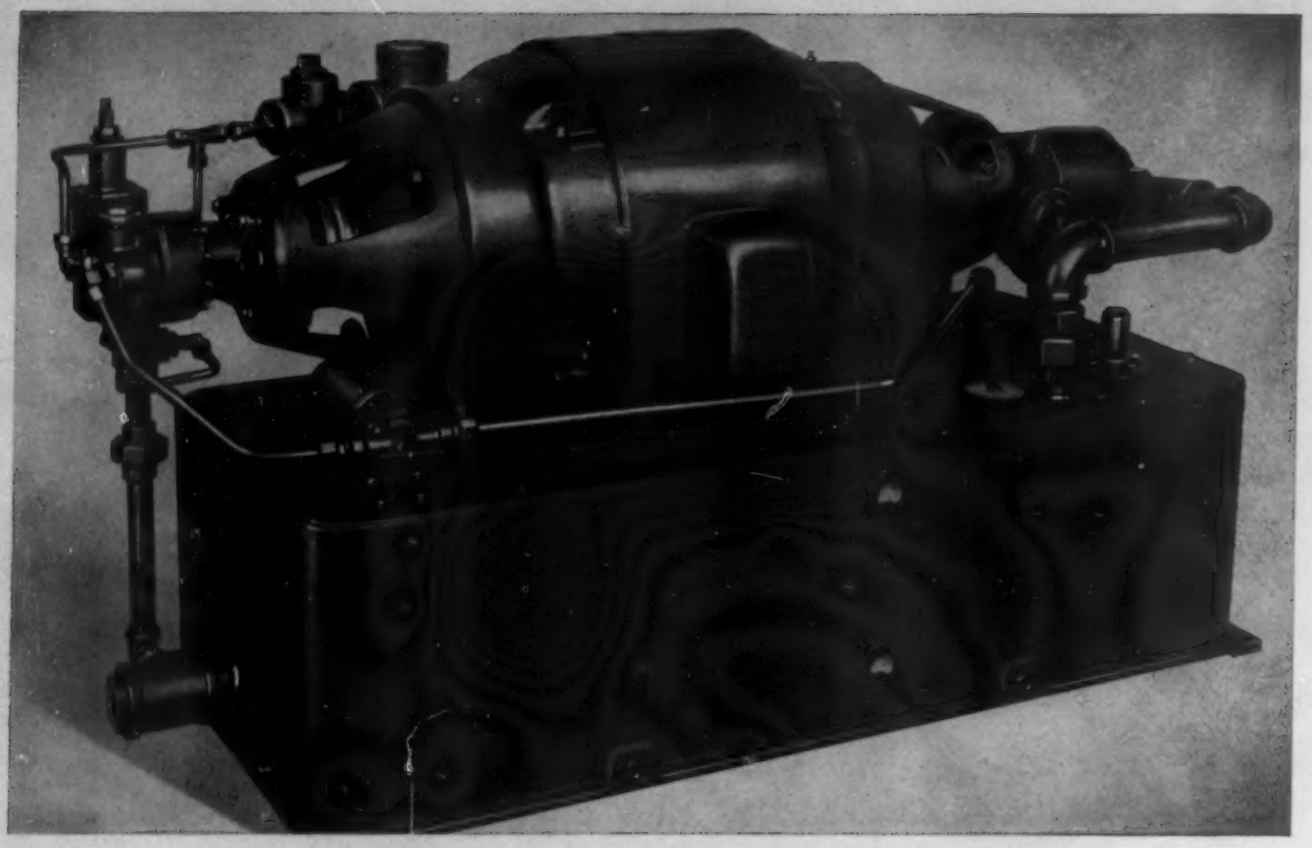

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Packaged Assemblies Combining High Pressure Low Volume and Low Pressure High Volume Pumps and Valves for Manual and Automatic Control

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These units have been in extended service in Rolling Mills • Textile Plants • Chemical Plants • Plastic Plants • Testing Laboratories • Research Laboratories • Rubber Plants • Powdered Metal Industry • Aviation Research • Airplane Manufacture for Standard Equipment and Production Test Procedure

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"IRON THAT WAGS ITS TAIL"

In molding this highly finished, streamlined handle for this swivel action iron from *Neillite, radio high frequency preheating by Megatherm is employed.

Neillite for the handle provides superior thermal qualities, high dielectric strength and polished beauty in design. Consult Watertown engineers on your problems of insulation, dielectric strength and utility combined with beauty in plastics moldings. The Watertown Manufacturing Company, Watertown, Connecticut. *Branch office*—Cleveland. Sales office in New York, Chicago, Detroit, Milwaukee and Hawaii.

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Send for the new Watertown Book of Plastics. Authoritative advice on choice of materials, types of moldings, charts, etc. Write Dept. X, The Watertown Manufacturing Co., Watertown, Conn.

Watertown

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COMMON SENSE ASSEMBLY ENGINEERING

ELIMINATES A "SPECIAL" FASTENING ...ADDS EXTRA SAVINGS!

Nor-Jay designed self-locking gas tank caps that met every market requirement. But they ran into troublesome, expensive assembly and decided to question the fastenings... special studs in the plastic cap, machine screws in the metal cap. The problem was up to a P-K Assembly Engineer.

Result – with P-K Screws they eliminate the special studs, add strength, save breakage of plastic caps, permit disassembly and eliminate blind tapping.

It's plain common sense to take a sharp look at fastenings in your product, whether it's in plan stage or production... common sense to start making the P-K savings you've been missing – often from 30% to 50% – by needless tapping, bolting, riveting, inserts in plastic.

A P-K Assembly Engineer will call at your request, or you can mail in assembly details for recommendations. Parker-Kalon Corporation, 208 Varick Street, New York 14, N. Y.

In both metal and plastic caps, three P-K Type "Z" Self-tapping Screws fasten the inside locking parts to the cap body, and another Type "Z" Screw secures the outside dust cap for the lock.

"HOW TO USE" Booklet – FREE. Get acquainted with the many types of P-K Self-tapping Screws and other Fastening Devices – learn how they cut assembly costs, improve products. Ask for Booklet No. 480.

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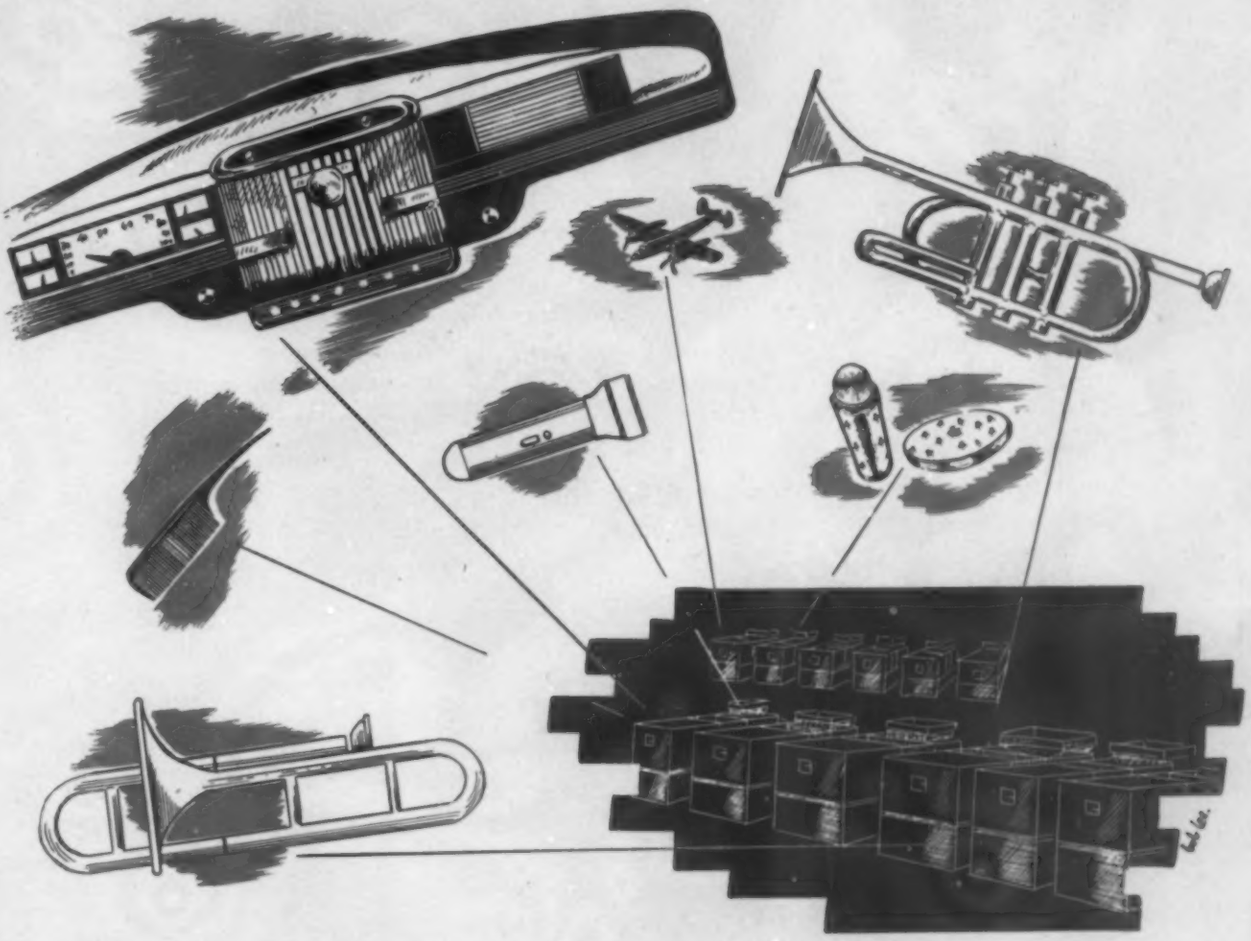
FOR EVERY METAL AND PLASTIC ASSEMBLY

UNIVERSAL'S

INJECTION MOLDERS BY THE DOZEN

SPEED PLASTIC PRODUCT PRODUCTION



If your new product calls for a plastic part — injection molded to precise specifications — *Universal Plastics* may be your best bet.

Our design engineers are at your service to help you plan new products and product improvements.

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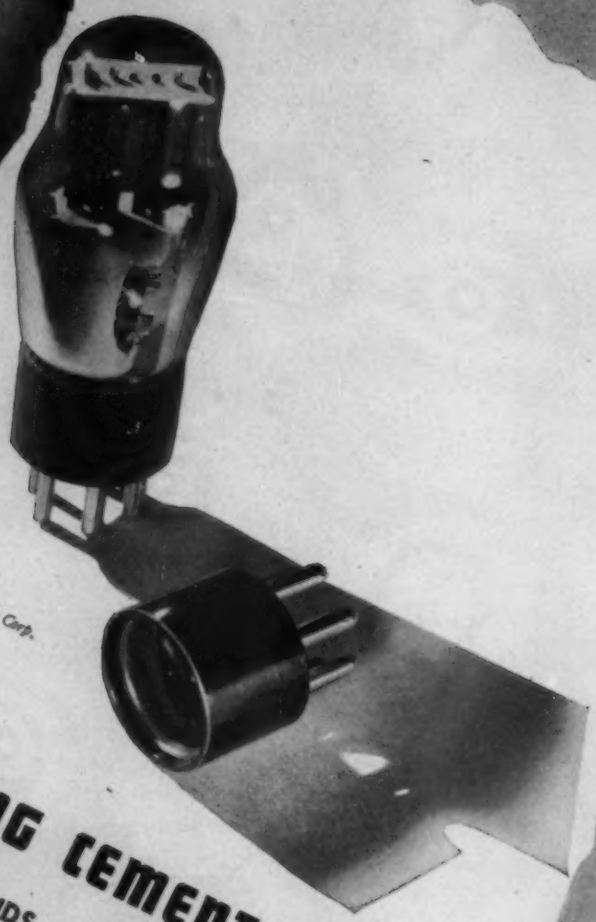

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BASING CEMENTS

MOLDING COMPOUNDS • INDUSTRIAL RESINS

DURITE PLASTICS INCORPORATED • 5000 Summerdale Ave. • Philadelphia 24, Pa.

Sides and rotors cored for circulation of cooling water or steam.
Power-operated sliding discharge door also cored for steam or water circulation.

HERE'S THE ANATOMY OF A BETTER WAY TO MIX PLASTICS

This drawing of the "insides" of a Banbury plastics mixer shows you the design elements that assure maximum thoroughness and uniformity in mixing plastics stock under close temperature control.

Essentially, the machine consists of a completely enclosed mixing chamber in which two spiral shaped rotors operate, a hopper to receive the material for mixing, and a sliding door for discharging the batch.

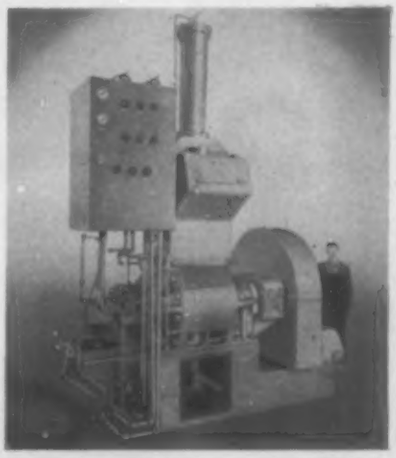
Revolving in opposite directions and at different speeds, the two rotors keep the stock in constant circulation. The ridge between the two cylindrical chamber sections helps force intermixing, and the acute convergence of the rotors with the chamber walls imparts a smearing action. This combination of intensive working produces a highly homogeneous mix.

Throughout the mixing process, you can keep the batch temperature under close control. Valves and gauges for the various temperature-regulating circuits shown in the drawing are mounted on a panel at the operating platform. By manipulating them it is a simple matter to bring the batch temperature to the desired point and keep it there. An electrically actuated potentiometer pyrometer with its thermocouple in direct contact with the batch, indicates and records the temperature on a chart.

An automatic timing device is also included on all production size Banburys.

•

Banbury Mixers are built in eight standard sizes for laboratory and factory use. For complete information write for bulletin No. 180.



Some Plastics Manufacturers Using Banbury Mixers

American Cyanamid Co., Bound Brook, N. J., Stamford and Wallingford, Conn.
Bakelite Corp., Bound Brook and Bloomfield, N. J.
Carbide & Carbon Chemical Co., South Charleston, W. Va.
Celanese Corp., Newark, N. J.
Columbia Recording Co., Bridgeport, Conn.
E. I. duPont de Nemours & Co., Wilmington, Del., Arlington, N. J.
General Electric Co., Pittsfield, Mass.
Hercules Powder Co., Wilmington, Del.
International Telephone & Radio Corp., Newark, N. J.
Masland Duraleather Co., Philadelphia, Pa.
Monsanto Chemical Co., Springfield, Mass.
RCA Victor Div., Radio Corp. of America, Camden, N. J.
Textileather Corp., Toledo, Ohio
Toledo Synthetic Products Co., Toledo, Ohio

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Plastic impregnators tell us that frequently machines need no attention or re-setting during an entire shift when "Pinko" is being used. Because of its controlled absorbency and uniformity of caliper your laboratory will want to experiment with "Pinko".
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A request addressed to our Plastics Research Laboratories will bring you samples of "Pinko" in various absorbencies and thicknesses. Feel free to ask for any specific data you require.
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which describes the Van Dorn Midget Molder and its applications.

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dimensional stability

low temperature strength

excellent electrical properties

low cost *

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You may or may not make or use liquid type flashlight batteries. But if you do use plastics in any way don't overlook the remarkable *chemical resistance* demonstrated by the Lustron from which those cartridges are made.

In this direct and prolonged contact with sulphuric acid, ***lustron remains perfectly stable.***

Likewise, hydrofluoric acid, which attacks glass, has no effect on Lustron. Lustron shows exceptionally good resistance to corrosive acids generally, to alkalies and salts, to lower alcohols (methyl, ethyl, propyl), mineral and vegetable oils . . . and to water, even after prolonged immersion.

And conversely, because Lustron contains no volatile plasticizers, it imparts no odor or taste to materials *it* contacts.

If you are manufacturing or distributing chemicals, drugs, cosmetics, liquors, foods . . . or if you mold the containers, closures, bottles, dispensers, parts or wares with which they come in contact . . . you should look into Lustron as your No. 1 material.

Complete information . . . on all of Lustron's advantages in performance and in production . . . plus technical advice in adapting this versatile polystyrene to your specific needs are yours for the asking . . . Write, wire or phone, MONSANTO CHEMICAL COMPANY, Plastics Division, Springfield 2, Massachusetts.

MONSANTO PLASTICS

The broad and versatile family of Monsanto Plastics includes: Lustron® polystyrenes • Cerex® heat resistant thermoplastics • Vinyl acetals • Nitron® cellulose nitrates • Fibestos® cellulose acetates • Thalid® for impression molding Resinox® phenolics • Resimene® melamines • Forms in which they are supplied include: Sheets • Rods • Tubes Molding Compounds • Industrial Resins • Coating Compounds • Vuepak,® rigid, transparent packaging materials

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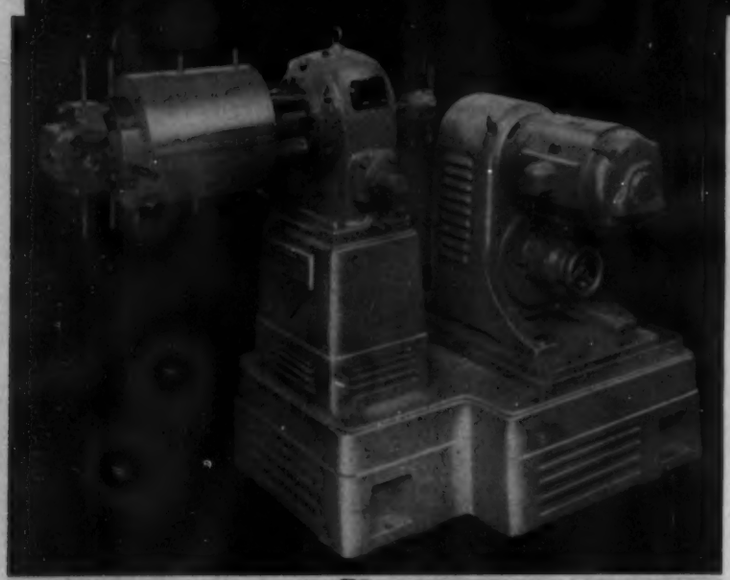
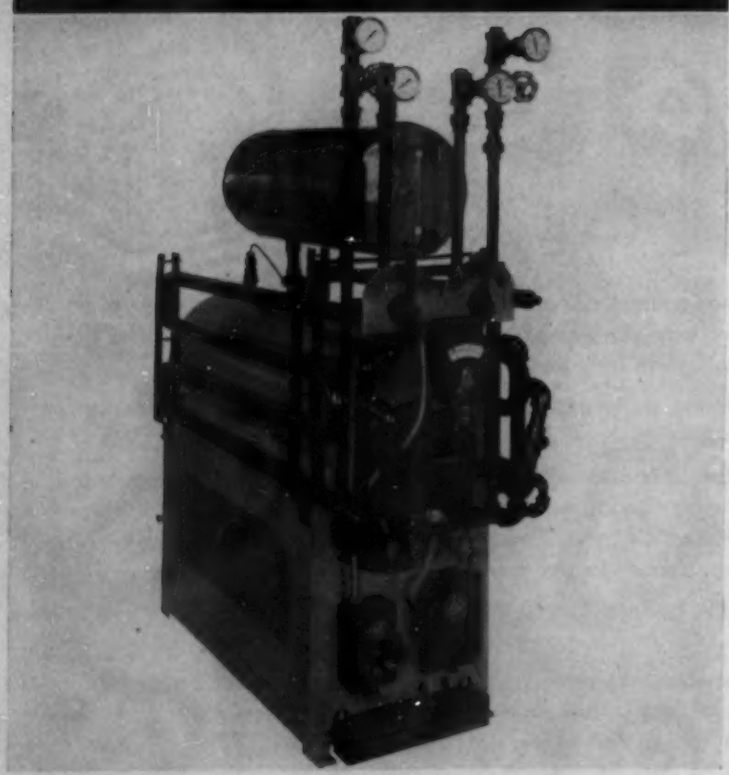
EXPERIMENTAL OR PRODUCT EXTRUDING





An experimental extruding machine capable of efficient and economical product extruding—that is the Royle #1 (2" bore) continuous extruding machine.

Through evolutionary development, features have been incorporated in Royle continuous extruding machines which will secure successful results with the growing list of extrudable compounds. The laboratory technician is assured that the results obtained with his Royle #1 will be reproduced with larger Royle models.

The inherent efficiency of Royle continuous extruding machines is further enhanced by the

EXTRUDER TEMPEATURE CONTROL UNIT

- **Wide temperature range available**
- **Sustains high or low extruding temperatures**
- **Supplies or removes heat from extruder as required**
- **Multiple circuits can be accommodated**
- **Hand lever selection of pre-determined extruding temperatures**
- **Available in two sizes**
- **Compact**

Whether you plan experimental or product extruding send for bulletins #443 and #444 and let them suggest to you how Royle extruding machines and the Royle Extruder Temperature Control Unit can meet your specific problem.

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Better Faster Lower Cost

✓ Check these advantages of Thermatron:

1 Electrodes designed for your specific requirements.
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3 Automatic control for unskilled operators.
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5 Complete overload protection.
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7 Safety switches protect unskilled operators.
8 All parts accessible for inspection and maintenanco.
9 Adjustable self-levelling upper electrode.
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11 Guaranteed components.

Thermatron electronic dielectric heating units are available in three power packed models — the Heatmaster, Heatmaster, Jr., Weldmaster — to satisfy most power demands and meet the exacting pre-heating requirements of molders.

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Use one of the three Thermatron models to "sew" all types of thermoplastic products, including shower curtains, tobacco pouches, cosmetic bags and raincoats, etc. Seals made in a fraction of a second — at a fraction of the cost.

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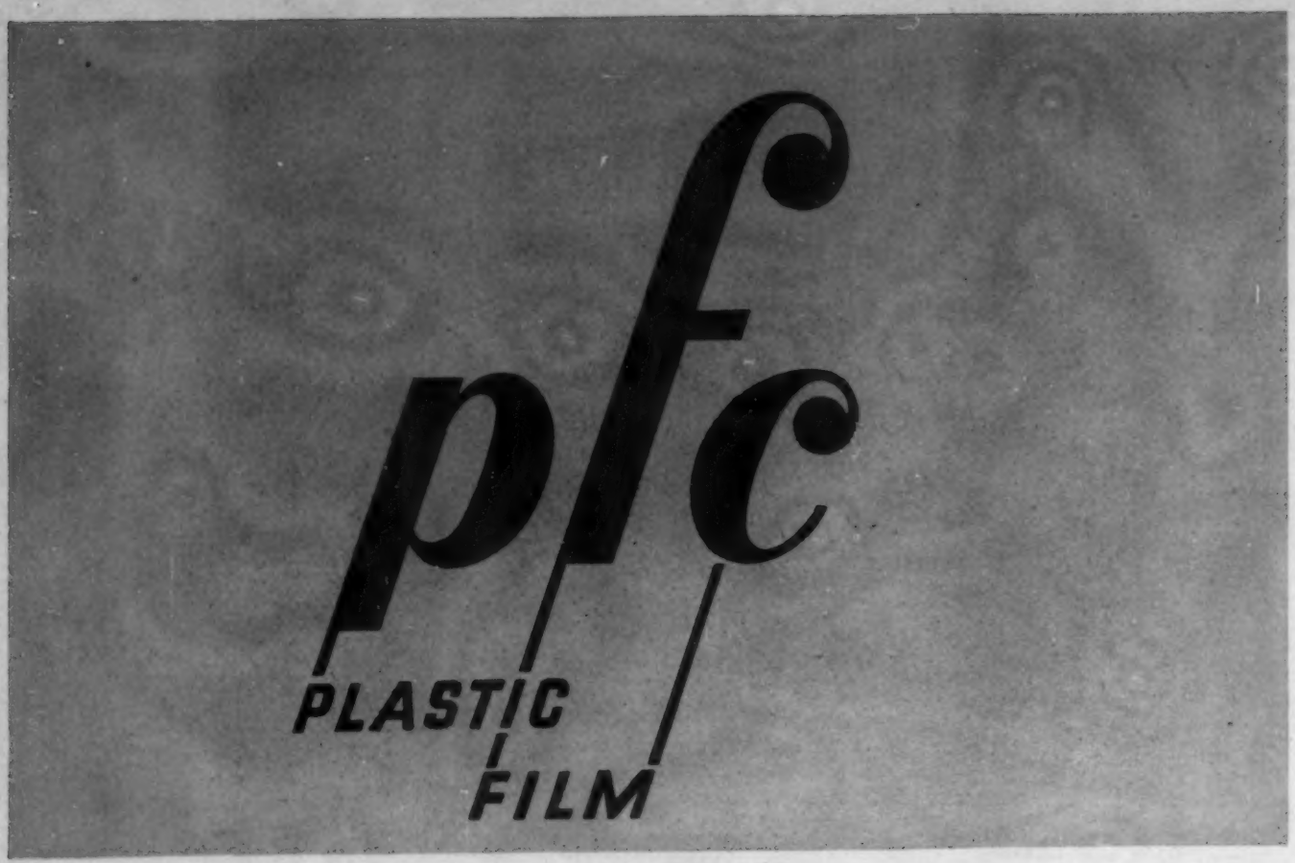

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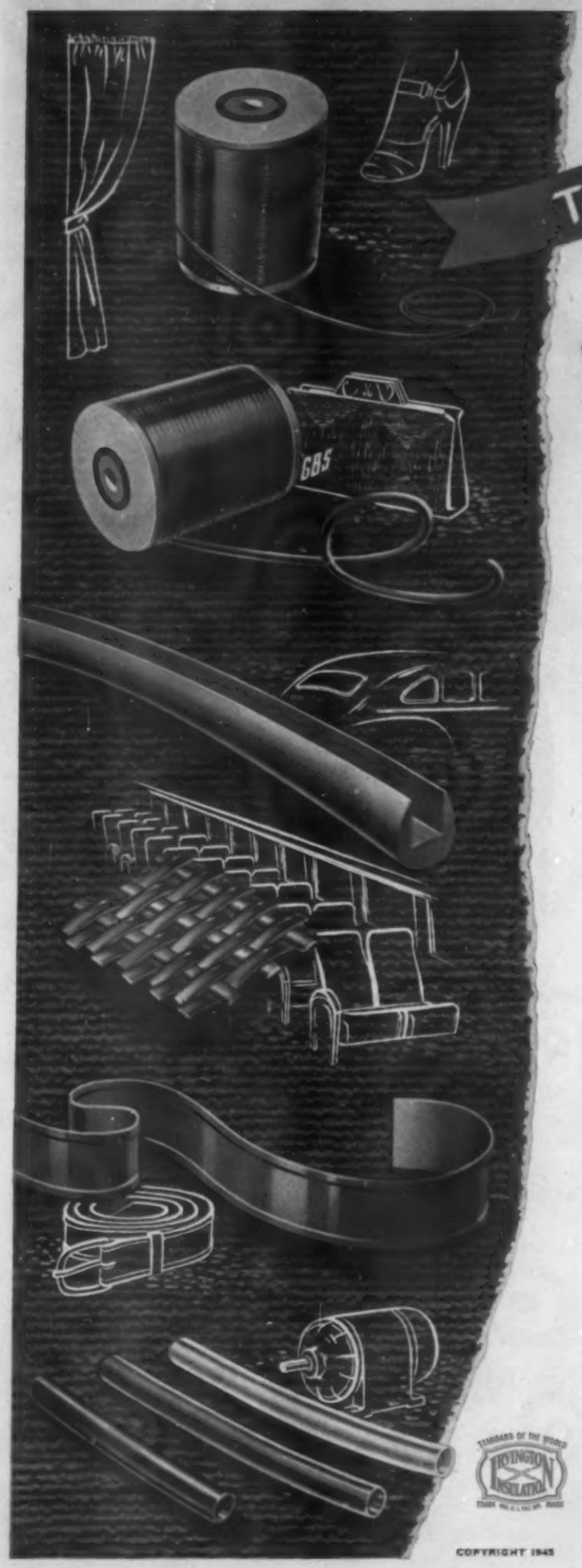

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Strips, Tapes, Sheets, Special Shapes . . . for novelty use, washers, spacers, liners, etc.

Whether you are designing for eye-appeal, broader utility, or lower costs, a Fibron extrusion *especially formulated* for your needs, may supply the answer. IRVINGTON engineers will gladly supply complete information on Fibron flexible extrusions, and cooperate on problems you may have. Write to Dept. 126 today.

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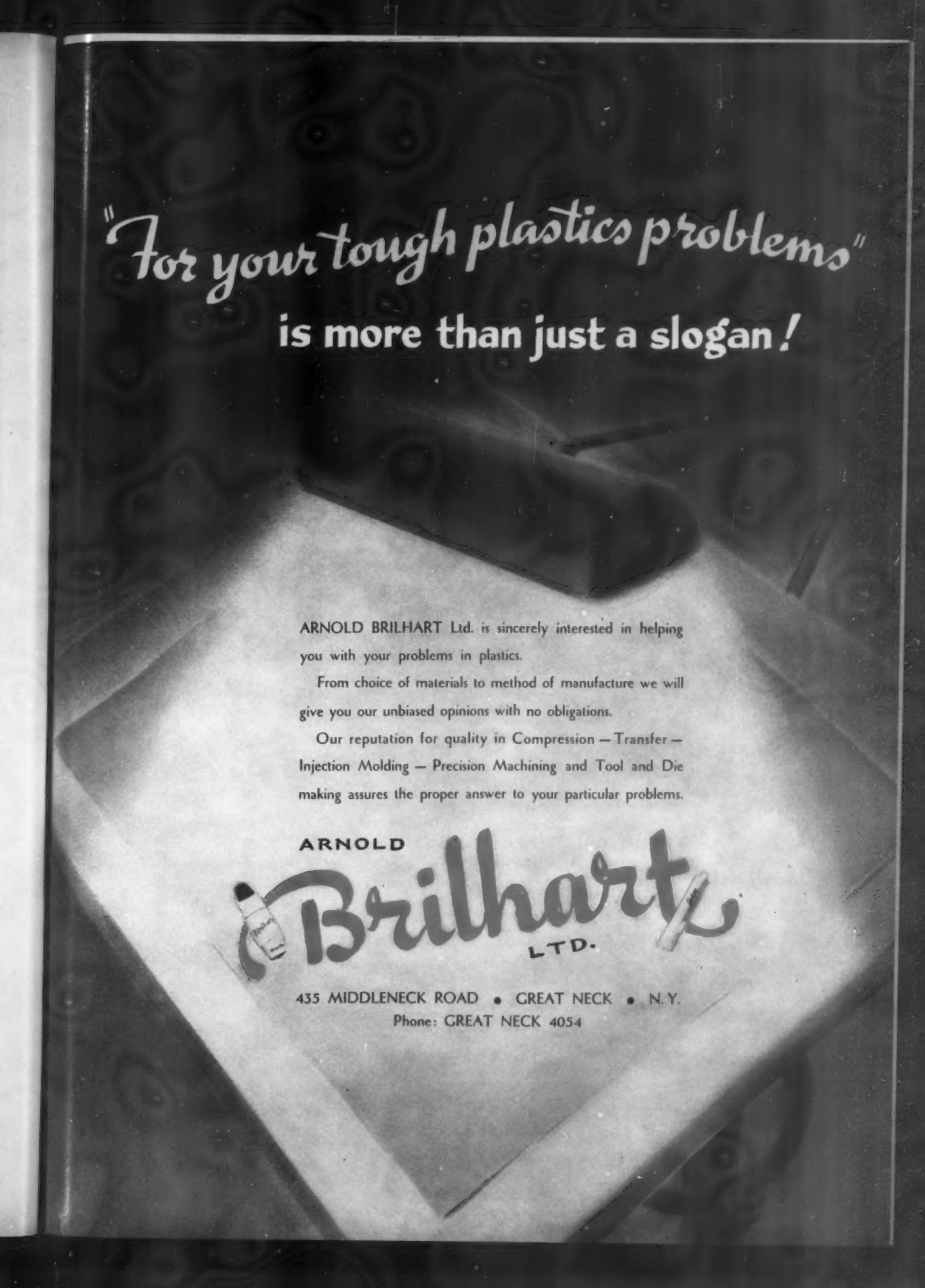
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Out of this huge mold comes a record player cabinet* that measures 16¾ x 14¾ x 6¾ inches. Even without its separately molded cover, this cabinet weighs 5.2 pounds.

Observe how this massive block of tool steel has been machined with micrometric precision. Notice how the mirror finish of the mold is reflected in the high polish of the molded piece, so attractive to the eye and to the touch.

It takes a good deal of equipment and skill to make a mold of this size. On the molding press, considerable production "know-how" is required to produce molded parts that are free from internal weakness or surface flaws. Here at MOLDED PRODUCTS we have the equipment . . . together with the necessary skill and experience. Submit your plastics problem or product to: MOLDED PRODUCTS CORPORATION, 4533 W. Harrison St., Chicago 24, Illinois.

**Molded for Admiral Corporation*

PLASTICS DIVISION
MOLDED PRODUCTS
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For *ALL* the Profit-Making Advantages of Electronic Preheating

2.5 kw
Model DH

SPECIFY AIRTRONICS*

COMPACTNESS

Never before has so much power and utility been packed into so small a space as in the *advanced* line of AIRTRONICS Preheaters.. For example, the 2.5 kw Model DH, with *all* the AIRTRONICS production-speeding features of control and operation, measures only 18" x 22" x 36"—small enough to locate easily wherever it may be needed.

SIMPLE OPERATION

All AIRTRONICS Preheaters have been designed for maximum simplicity of operation. Power output and preheating time are *automatically* controlled. To operate, the molder simply places the charge between the sturdy self-positioning electrodes, closes the hood and presses the proper "start" button.

EASY ADJUSTMENT

Dual power and time controls are mounted on a pivoting panel recessed in the cabinet front. Tilted out, the panel is fully accessible for set-up adjustments. Tilted in and locked, the set-up controls are *completely out of the way*, preventing unauthorized changes.

VERSATILITY

AIRTRONICS Dual Load Selection, Automatic Power Regulation and Wide Range Load Accommodation make possible efficient handling of a greater variety of preheating jobs than ever before. In particular, the dual set-up controls permit running two entirely different loads, alternately, or in any sequence.

These are but a few of the many improvements that have been incorporated into AIRTRONICS Preheaters to provide the plastics molder with *all* the production advantages of electronic preheating. Other improvements include Automatic Excitation Regulation, which maintains maximum preheater efficiency; and powerful Vacuum Cooling of the high frequency components, which assures trouble-free performance under the most rigorous operating schedules.

Inquire at any AIRTRONICS office for full details about the complete series of AIRTRONICS Preheaters, including models from 2 to 10 kw.

* REG. U. S. PAT. OFF.

Airtronics MANUFACTURING CO.

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No less important than design in plastic molding, is engineering — a factor measured by capability earned the hard way.

MACK MOLDING engineering embraces all the essentials for product efficiency and dependability — design, material, cost, ultimate function, service-life expectancy, etc.

Naturally it is not to be inferred that any "Tom, Dick or Harry" product will — if given the nod by MACK MOLDING — sell all comers. Rather, if you are definite in practicability and appeal, MACK MOLDING will clear the path of sales hazards through product inferiority or inefficiency from a molding standpoint.

If you are in need of intelligent cooperative plastic molding, address inquiries to Mack Molding Company, Inc., 120 Main Street, Wayne, New Jersey.

TASTE AND AROMA? Resistance to chemicals, acids, corrosives, alkalis, etc., have an important say in the engineering of MACK MOLDING items.

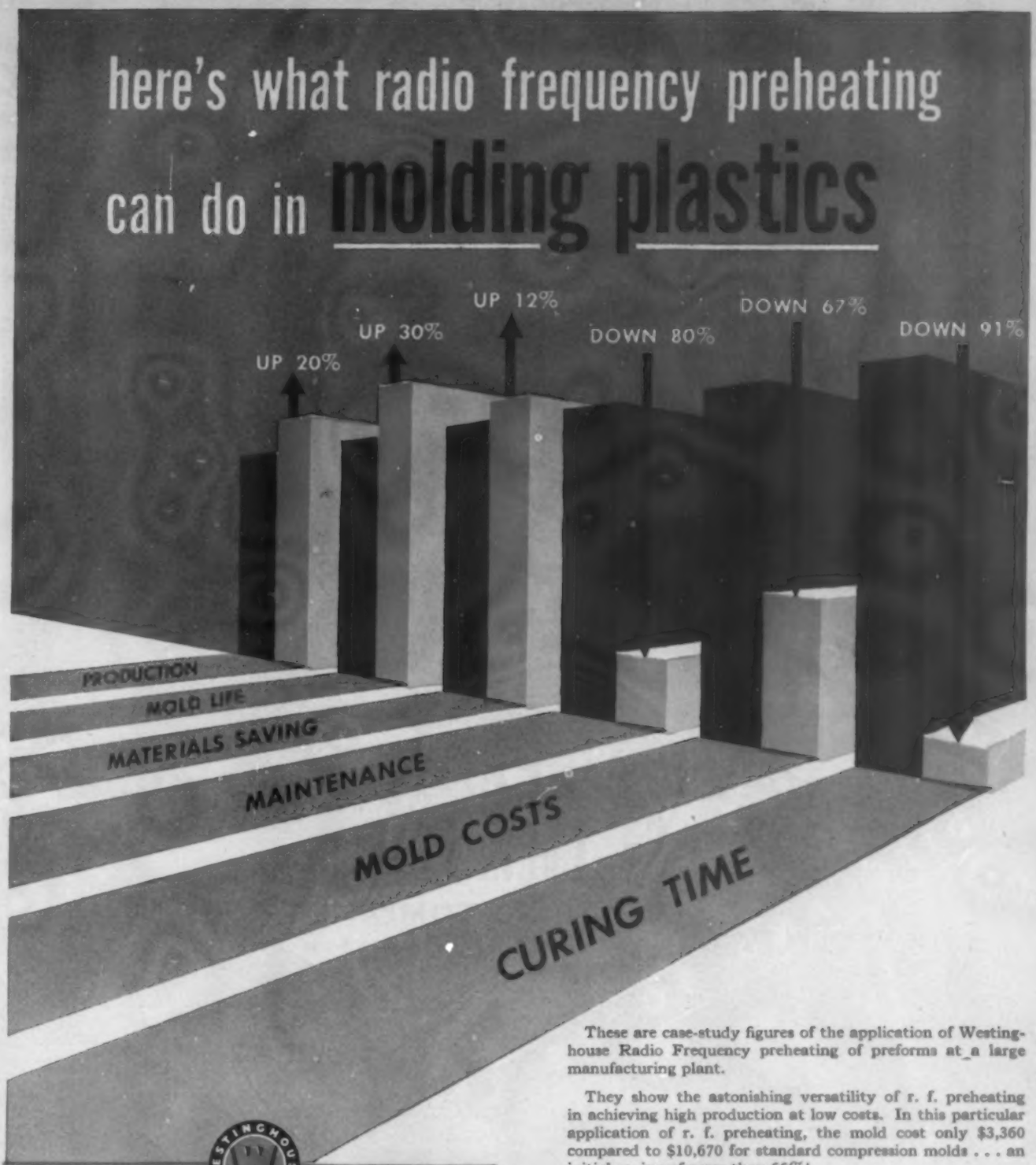
SHOOTING STAR— electronics is the "jet job" of industry, and it gets special consideration by MACK MOLDING engineers. Electrical and mechanical characteristics are followed to the letter.

IN APPAREL, engineering too, can assure enthusiastic acceptance. Good wearing qualities, style and color — incepted in the laboratory — can often set the mode.

Mack MOLDED EXCELLENCE

SALES OFFICES: NEW YORK CITY, CHICAGO, DETROIT, INDIANAPOLIS, BOSTON & ST. LOUIS.

here's what radio frequency preheating can do in molding plastics



These are case-study figures of the application of Westinghouse Radio Frequency preheating of preforms at a large manufacturing plant.

They show the astonishing versatility of r. f. preheating in achieving high production at low costs. In this particular application of r. f. preheating, the mold cost only $3,360 compared to $10,670 for standard compression molds . . . an initial saving of more than 66%!

The bar chart above illustrates how such exceptional savings apply in every phase of r. f. preheating. And the flexibility of r. f. preheating adapts it perfectly to many operations . . . it is ideal for making parts with long, slender holes because the reduced pressure does not bend or break mold pins. Metal inserts can be molded better by the r. f. technique.

Standard ratings are available from 1 to 20 kw, and up to 200 kw if your application requires this power. You can learn more about Radio Frequency preheating and its applications to your molding by writing your nearest Westinghouse office. Or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

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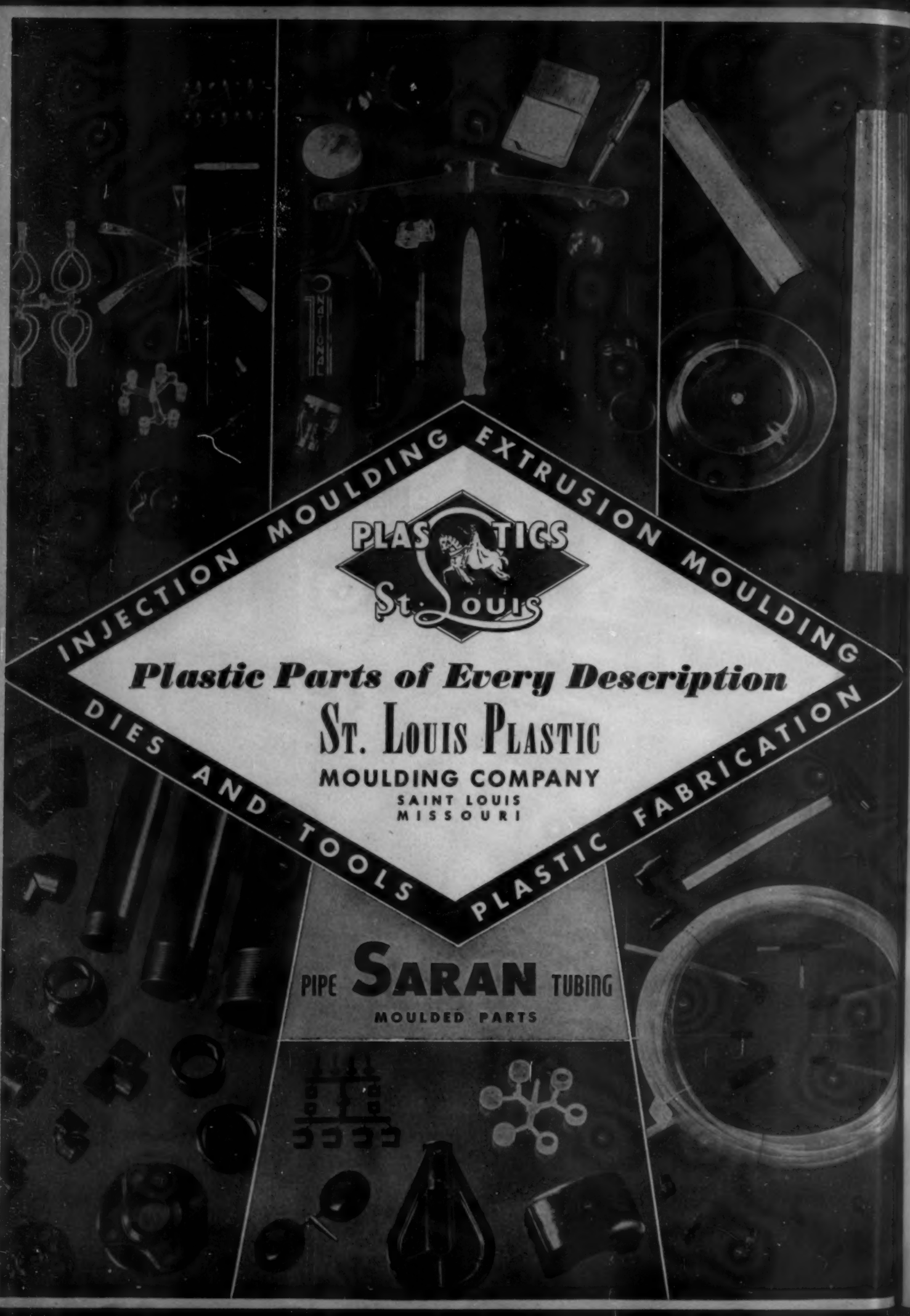
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Molding a Reputation

Cabinet-type Elmes self-contained plastic molding press with stroke control, adjustable pressure control, automatic time cycle, and push-button-actuated semi-automatic operation.

Is your reputation, and ours, what *we* make it? Yes, in a sense. But the good name of any manufacturer, or any product, is a Citation for Merit bestowed by someone *else*.

Claims can never build the kind of reputation you want. It's *performance*—time after time, again and again—that wins confidence. And customer confidence is the *finest* asset any business can have.

It's Service That Counts

Molders who turn out quality plastics on schedule, who have the equipment for speedy, economical production, and who can depend upon their equipment to perform *within* cost estimates, are molding a reputation that means profits today, and *tomorrow*.

A good reputation is a *living* thing—fed by consistently good work, ever higher standards, ever better products. It endures upon persistent progress, integrity, performance at its *best*. There can be no substitutes.

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NOMINATIONS ARE NOW BEING ACCEPTED

BY THE COMMITTEE FOR

THE JOHN WESLEY HYATT AWARD

FOR THE ADVANCEMENT OF PLASTICS

Fifth Annual Award

The John Wesley Hyatt Award, consisting of a gold medal and $1000, is made annually to the individual who has made, in the opinion of the judges, outstanding achievement of wide importance to the plastics industry. Nominations close March 15, 1946.

ENTRIES

Any person, whether he be a molder, toolmaker, laboratory technician, executive, or engaged in any other capacity, is eligible to submit one or more entries. There is no fee of any kind. Anyone may enter or be entered. Statements of qualification (Entry Blanks) are being mailed to the Industry. Additional entry blanks may be obtained from the Committee Secretary, 295 Madison Avenue, New York 17, N. Y.

PREVIOUS MEDALISTS

1941 — Dr. Donald S. Frederick, Plastics Division, Rohm & Haas Company, Philadelphia, for adaption of large transparent colorless sections of methyl-methacrylate to bombers and other military aircraft.

1942 — Mr. Frank Shaw, President, Shaw Insulator Company, Irvington, N. J., for development of the process for transfer molding of thermosetting materials.

1943—Dr. Stuart D. Douglas, Head of Plastics Research, Carbide and Carbon Chemicals Corporation, South Charleston, W. Va., for his outstanding research work in the polymerization of vinyl compounds, the increased commercial production of which, in 1943, made possible the manufacture of war materials urgently needed by the nation for the prosecution of the war.

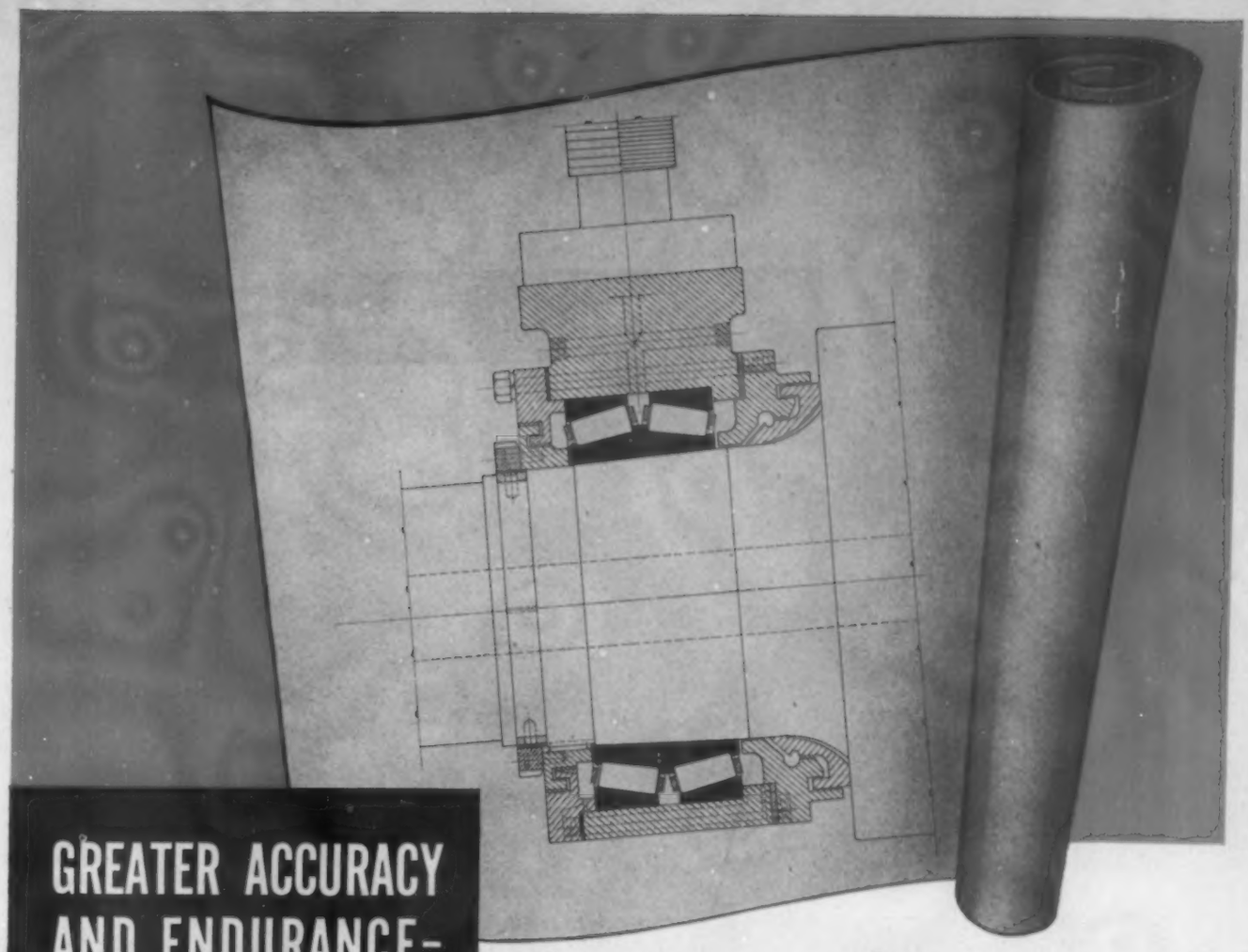
1944—Mr. William Iler Beach, Chief Plastics Engineer, North American Aviation, Inc., Inglewood, Calif., for his research and development on the process of post-forming phenolic laminates, which materially helped to increase production and improve performance of airplanes through the replacement of metals with plastics.

THE JOHN WESLEY HYATT AWARD

Secretary to the Committee:

WILLIAM T. CRUSE, 295 Madison Avenue, New York 17, N. Y.

CP-69



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GREATER ACCURACY because (1) Timken Tapered Roller Bearings are inherently fine precision mechanisms. (2) The tapered design of the Timken Bearing enables extremely fine adjustments to be made during installation in the machine to assure minimum vertical movement of the calender rolls regardless of the operating temperature of the calender. (3) Calender rolls may be reground on Timken Bearings, thus eliminating the need of stripping bearings and boxes from the roll necks.

GREATER ENDURANCE because (1) Timken Bearings are designed to carry all loads — radial; thrust; or both together in any combination. (2) Timken DIT Type Balanced Proportion Bearings as shown in the drawing provide (a) excess load capacity, (b) excess neck strength and maximum rigidity. (3) Timken Bearings are made of Timken Alloy Steel — tops in strength and wear resistance.

To make sure of getting all these advantages in your calenders, see that the trade-mark "TIMKEN" is stamped on every bearing you use. Our engineering department is at your service for consultation at all times. The Timken Roller Bearing Company, Canton 6, Ohio.

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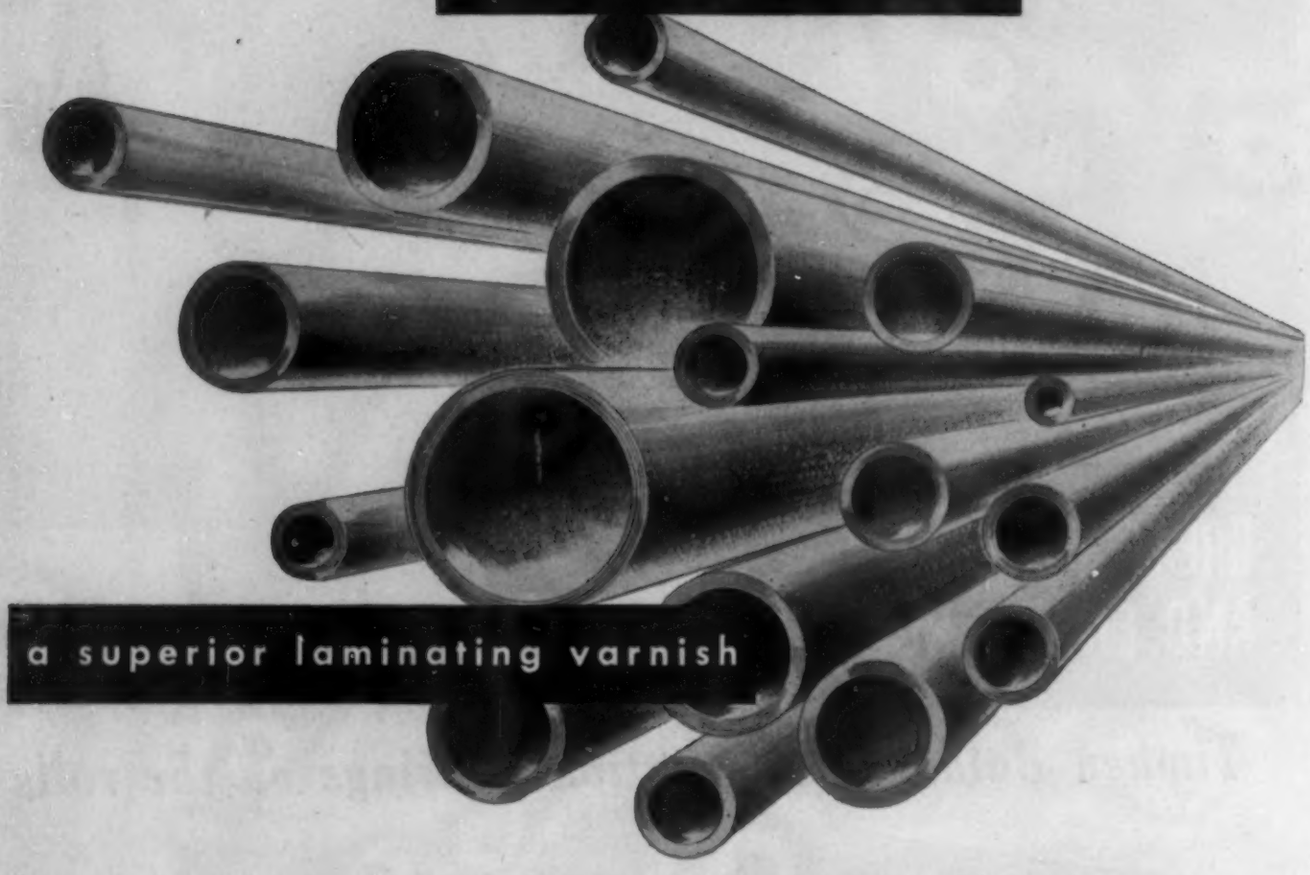

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Developed especially for the production of laminated tubing, No. 5016 Plyophen has proved its worth in flat sheet stock production as well. When used for heavy-wall tubing this phenol-base varnish permits production of tubing without the cracks that often follow curing. To either tubing or flat sheet stock it imparts high water resistance and mechanical strength. For information on this valued member of RCI's versatile Plyophen family of phenolic resins write direct to the Sales Department.

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Perhaps you have thought: "How can I increase my sales through better packaging?" You will find the answer in "Pack To Attract," a booklet containing 23 packaging ideas that lead to more profitable packaging procedure. It shows how corrugated board, in the hands of H & D Package Engineers, is transformed into sales packages that protect in transit and attract at point-of-sale. It shows how modern packaging has become an outstanding sales influence. Get your packaging ready now—send for your copy of "Pack To Attract." The Hinde & Dauch Paper Company, Executive Offices, 4608 Decatur Street, Sandusky, Ohio.

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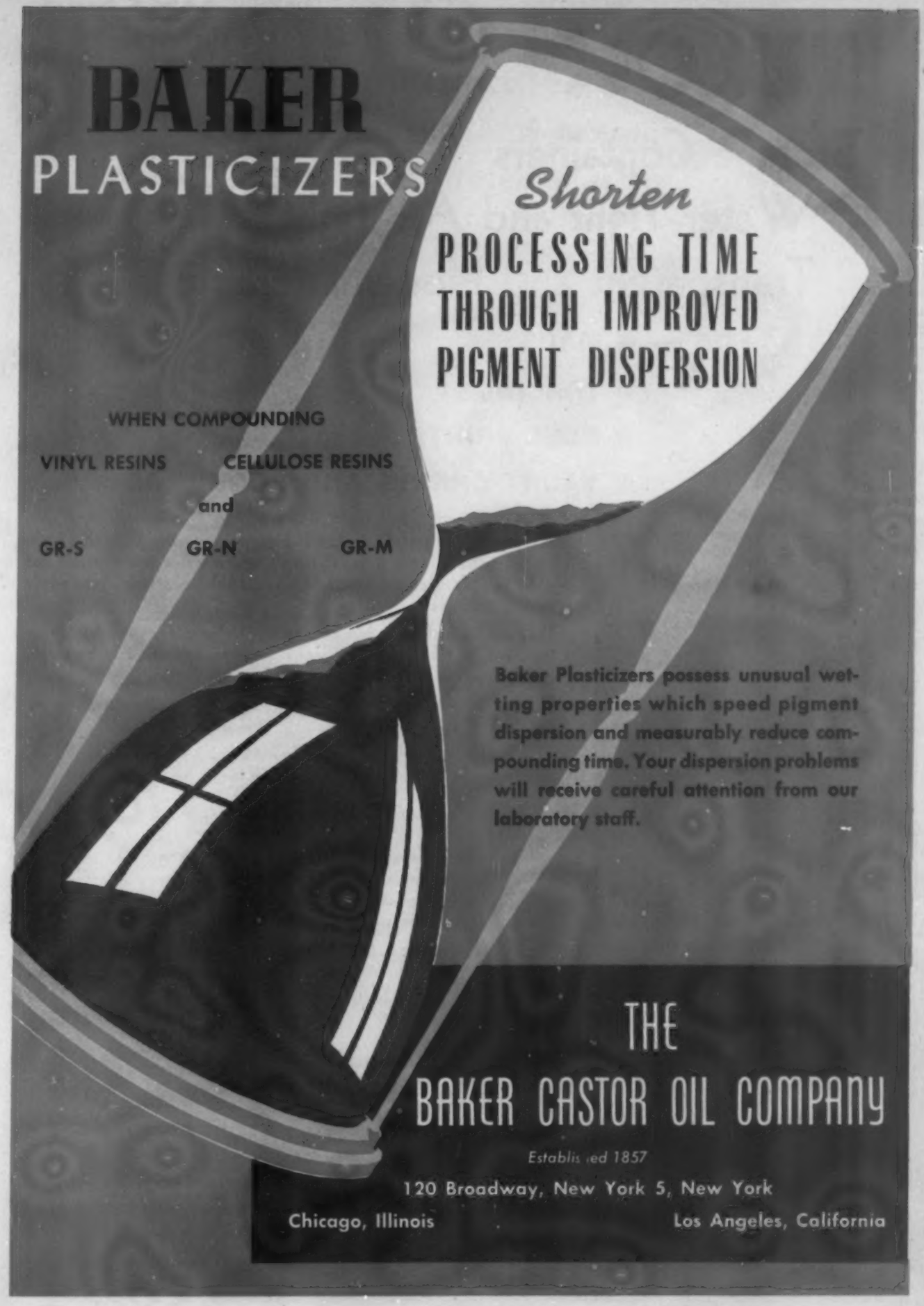

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Storage Containers
Water-Tight and Air-Tight
Transparent and Non-shatterable

FOR —
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- **BLUE PRINTS**
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Installation of TULOX blue print containers in one of the leading U. S. aircraft plants.

These containers are manufactured from our well-known TULOX TT tubing, made from Tenite II, cut to length, with a sealed-in transparent end and a flexible black synthetic rubber removable plug, making the whole container water and air-tight.

They are invaluable for permanent storage of war records, original tracings, and for the transportation of blue prints and drawings by public utility companies, etc.

These new containers are available in two standard diameters, approximately 1½" I. D. and approximately 1⅞" I. D.

They can be supplied in any length from 12" up. For special lengths a 1" allowance should be made on the overall length for the removable plug.

PRICES

	1⅝" O.D.	2" O.D.
36" inside dimensions (37" overall) —	$1.70 ea. —	$2.10 ea.
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The above prices are F. O. B. Our Plant, Norwalk, Connecticut, and are subject to discount for quantities.

May we send you our latest technical data sheet and photo folder of other TULOX end-uses?

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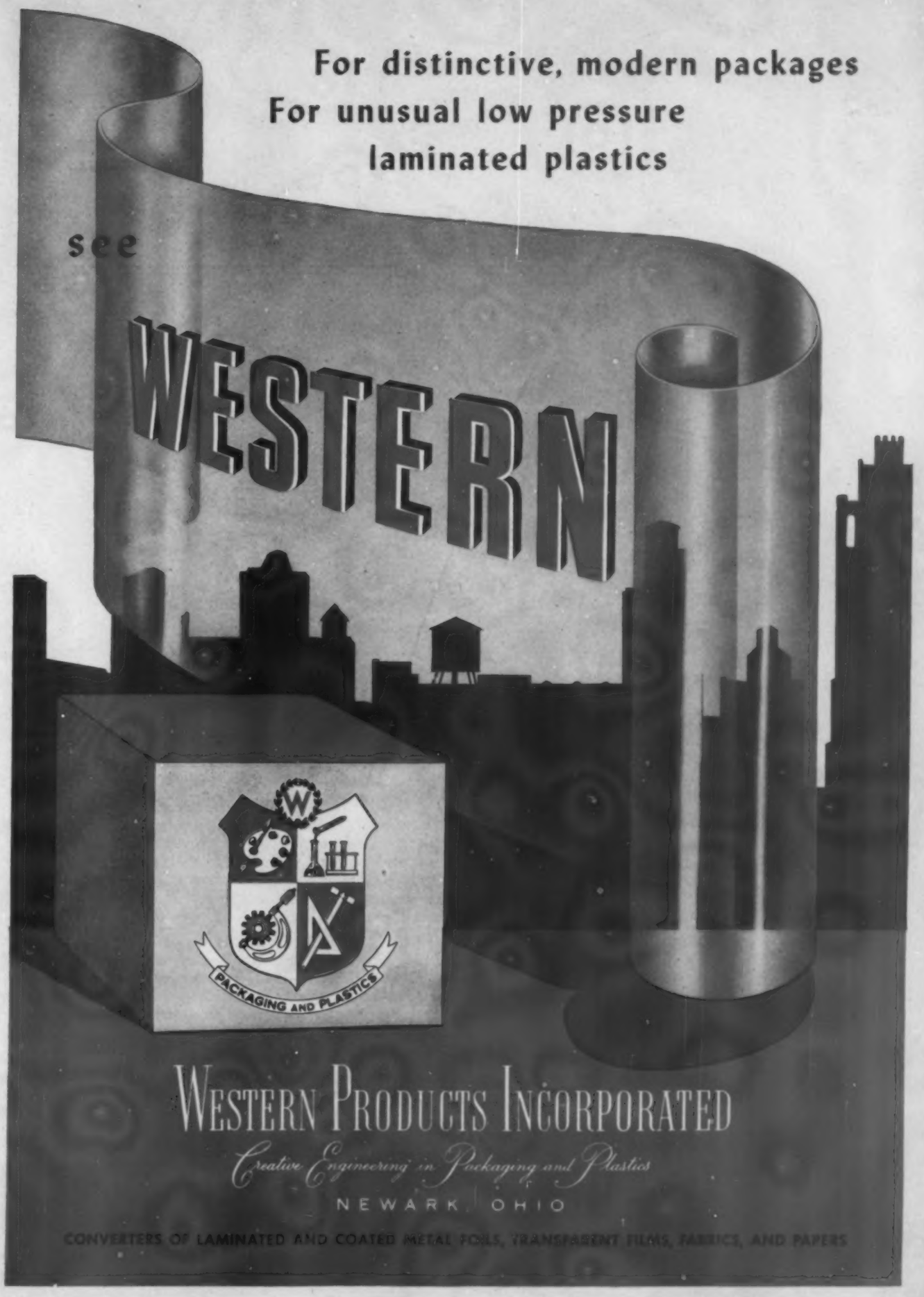
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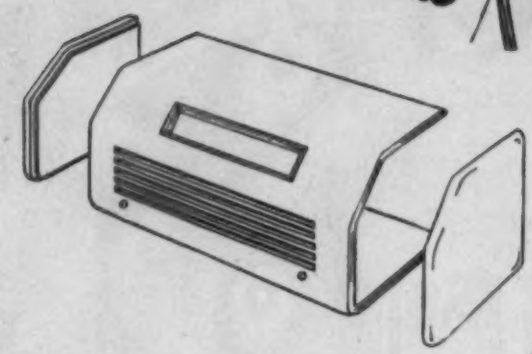
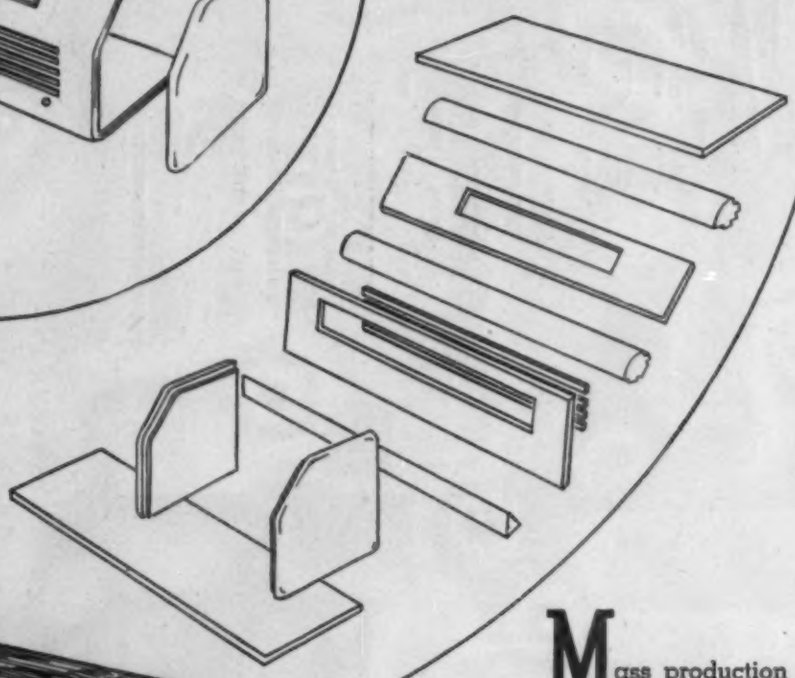
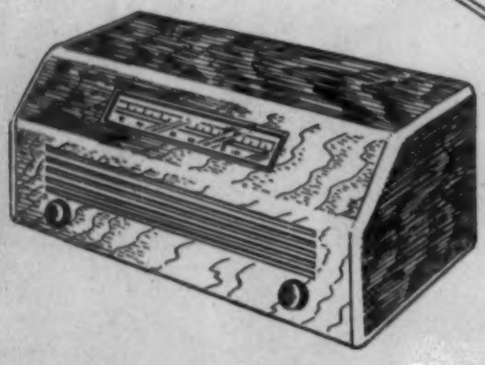
PENACOLITE *room temperature setting adhesive*

3 PLUS G-1215 = 9







Mass production of fine wood assemblies is simpler, quicker and less expensive with veneers and plywood molded and bonded with PENACOLITE G-1215. Just one example of this modern adhesive's wonder working is in the production of the richly styled and finished radio cabinet illustrated here.

Note the six operations eliminated from the assembly. Note the curved shape of the casing which, when molded with PENACOLITE G-1215, will never warp or delaminate. And note, too, the surface—a paper-thin veneer which permanently endows the entire cabinet with the quality of any fine wood you may select.

For advice and assistance in applying PENACOLITE G-1215 to your production and to your product, consult PENACOLITE Division.

Write PENACOLITE DIVISION

PENNSYLVANIA COAL PRODUCTS COMPANY
PETROLIA, PENNSYLVANIA

• Distributed in Canada by **CANADIAN INDUSTRIES, LIMITED**, Montreal, Canada

Positive Fastening . . .

FOR YOUR PLASTIC PARTS!

Speed assembly, improve product performance and reduce costs with Shakeproof Type 25 Thread-Cutting Screws. Each screw cuts its own thread into plastics as you drive it! Eliminates inserts!

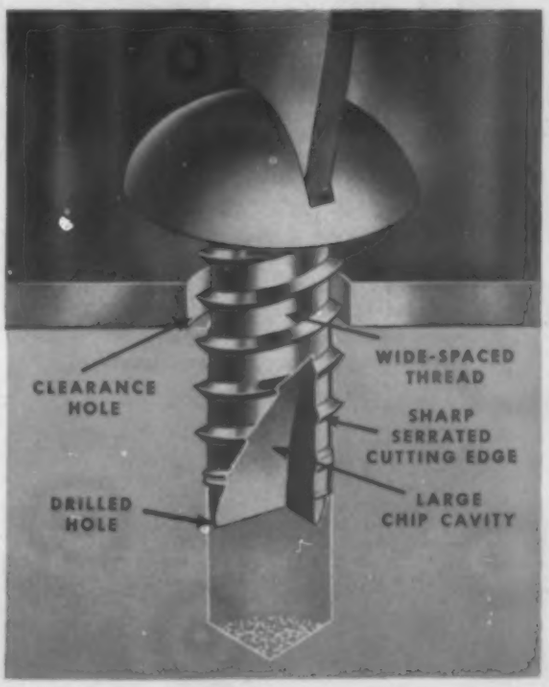
The unique cutting action of the Type 25 provides freedom from dangerous stresses or strains that are likely to cause fractures in molded plastics. Because the screw remains in the thread it has cut itself, a perfect mating thread is assured which results in a snug, tight fit.

Write today for free sample test kit—contains a variety of sizes and head styles. Ask for Kit No. 10.

SHAKEPROOF

TYPE 25

THREAD-CUTTING SCREWS



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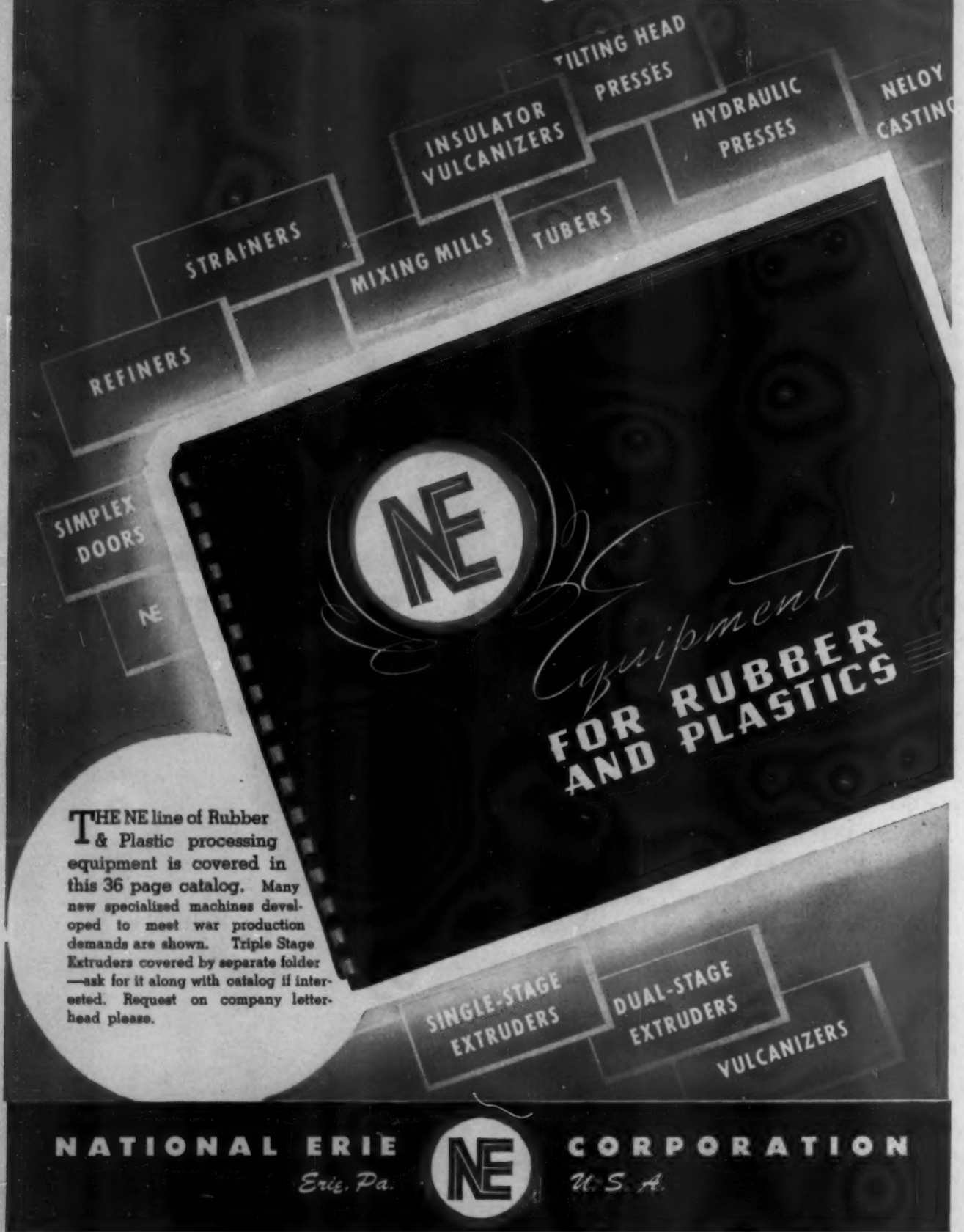
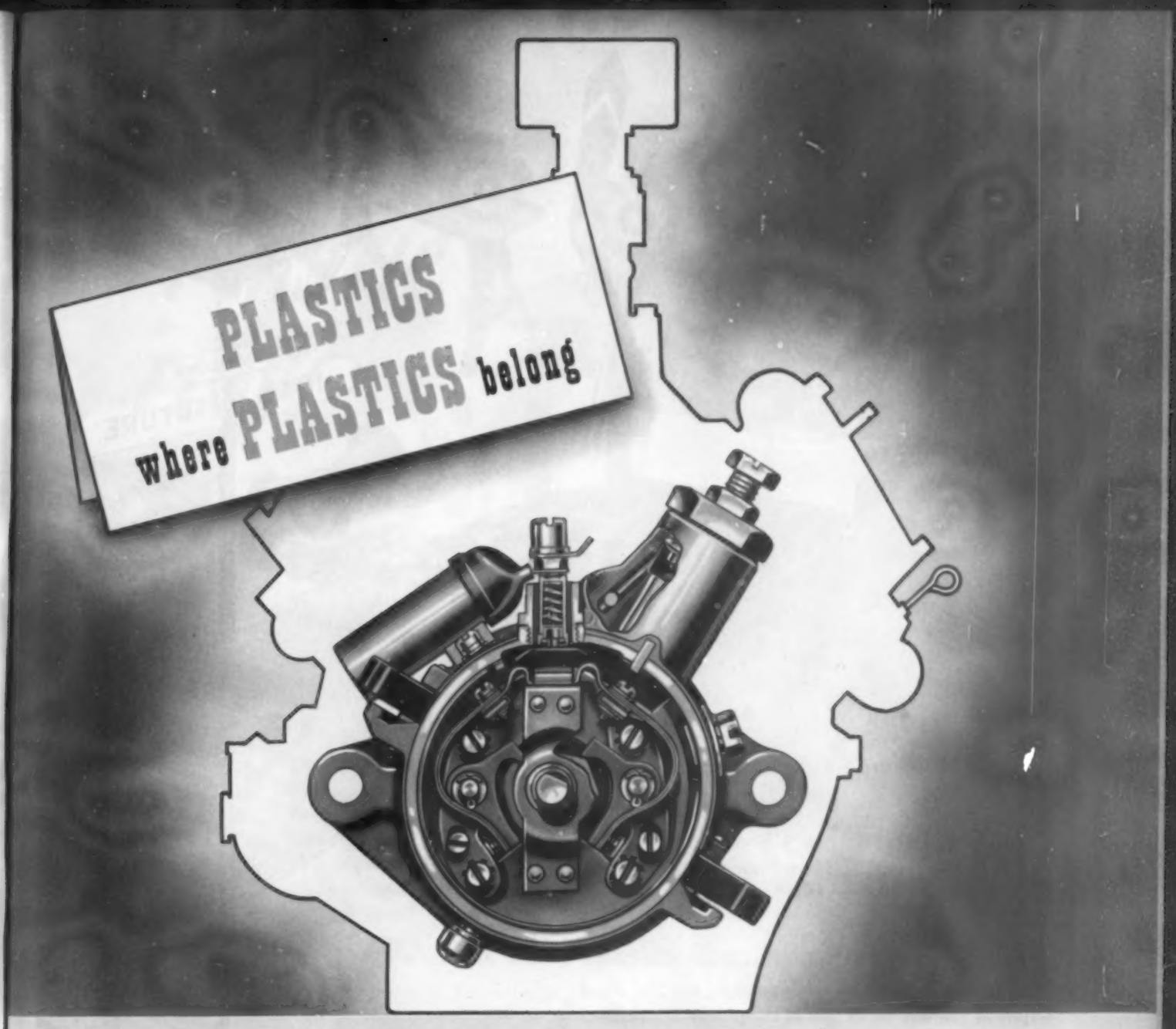
WRITE FOR THIS *New* CATALOG



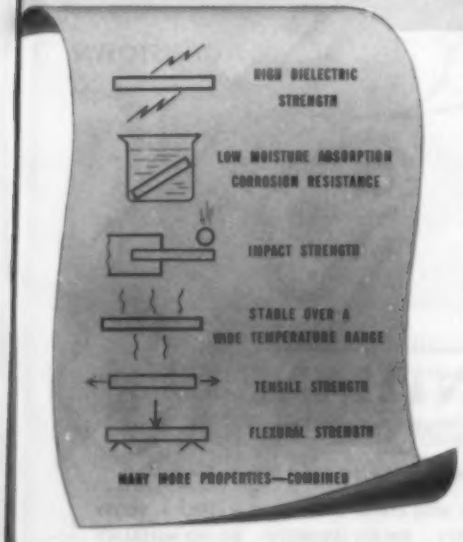
THE NE line of Rubber & Plastic processing equipment is covered in this 36 page catalog. Many new specialized machines developed to meet war production demands are shown. Triple Stage Extruders covered by separate folder—ask for it along with catalog if interested. Request on company letterhead please.

NATIONAL ERIE CORPORATION

Erie, Pa. NE *U. S. A.*



Using High Impact Fatigue Strength, Wear Resistance



THE BREAKER ARM is an important small part in any automotive ignition system. Synthane for this application is a good example of using plastics where plastics belong.

Synthane qualifies here because of its high resistance to impact fatigue, excellent wearing qualities, and insulating characteristics.

For these reasons, or possibly others, Synthane may be just what you need in your product. It's easy to find out, and almost always better to find out before you design.

Perhaps we can help you fit plastics into your job, and furnish you the necessary materials or the complete part ready to install. In any event, don't hesitate to call on us. And write for the complete Synthane catalog.

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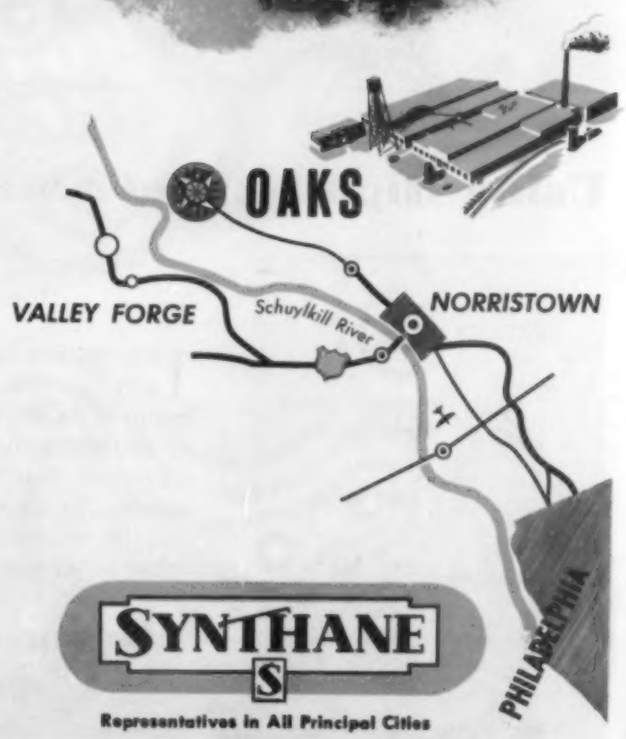
SYNTHANE

SYNTHANE TECHNICAL PLASTICS • DESIGN • MATERIALS • FABRICATION • SHEETS • RODS • TUBES • FABRICATED PARTS • MOLDED-LAMINATED • MOLDED-MACERATED

HOW TO BRIDGE THIS GAP QUICKLY

HERE, on the "banks" of '45 are a handful of the thousands of products stranded by the flood waters of the war in '41. All of them were applications making use of our type of plastics—Synthane. You are probably taking up where you left off or going into new lines of manufacture.

If you are a little rusty on the pre-war part Synthane might have played in your product, or need assistance in designing for the use of Synthane in new or improved products, send for our complete catalog, or ask for our help now.



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Gentlemen:

Please send me without obligation the complete catalog of Synthane technical plastics.

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SYNTHANE

Representatives in All Principal Cities

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OLSEN-BAKELITE PLASTIC FLOW TESTER

The Recognized Standard for Laboratory Testing and Production Control

The Olsen-Bakelite Flow Tester was developed for use on thermo-plastic and thermo-setting materials. It has found increasing usage in the plastics industry because of the wide variety of materials which fall in one or the other of these classifications — all of which must be accurately rated in order to assure uniformity and efficiency in production.

What the Olsen-Bakelite Flow Tester Does:

1. Provides for controlling and varying the temperature as it is being applied to the material being tested.
2. Provides for application of pressure in units of 100 lbs. per square inch up to 3,000 lbs. per square inch.
3. Determines the plasticity properties while these changing conditions are taking place.
4. Assures an accurate means of observing and recording the results of such changes. For this purpose an automatic recording device is furnished.
5. Thus the machine plots the flow of the material against time.

If you have not already received your copy of Bulletin 23, giving details of the complete line of Olsen Plastics Testing Equipment, write today on your company letterhead and a copy will be sent to you by return mail.

Proving every day that the value of testing depends on the quality of the testing equipment.

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PHYSICAL TESTING EQUIPMENT • BALANCING MACHINES

Fabrics for new Plastic Products

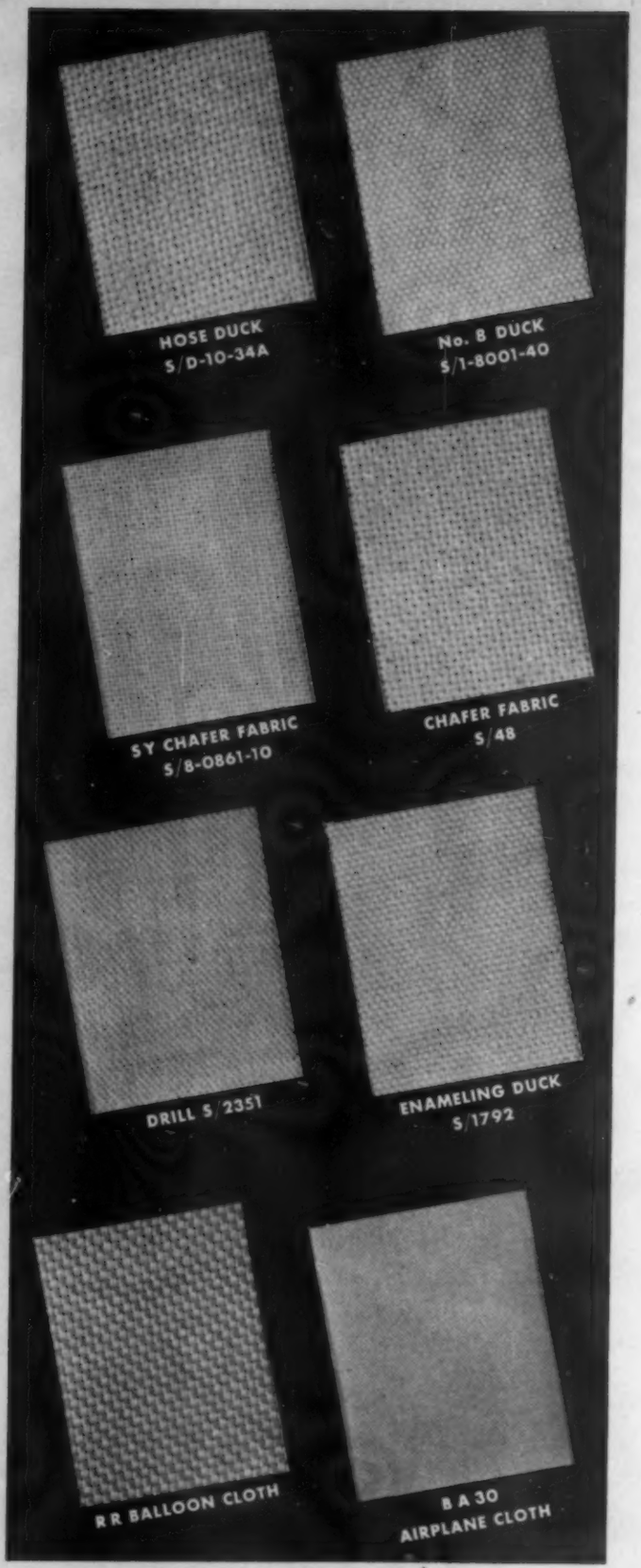
Our unusually wide range of fabrics for plastics offers plastics manufacturers an opportunity to select the fabric most suitable for each individual product.

In addition, we maintain the finest textile research laboratories and are constantly working on the development of new fabrics for special purposes.

Our textile experts are available to consult with you on the selection of the most suitable fabrics for your products or processes.

Send for Sample Book

These fabric samples for the Plastic Industry represent 12 types of fabric—selected from several thousand fabric constructions made in the mills we represent. In addition to standard constructions, we develop fabrics to specifications.



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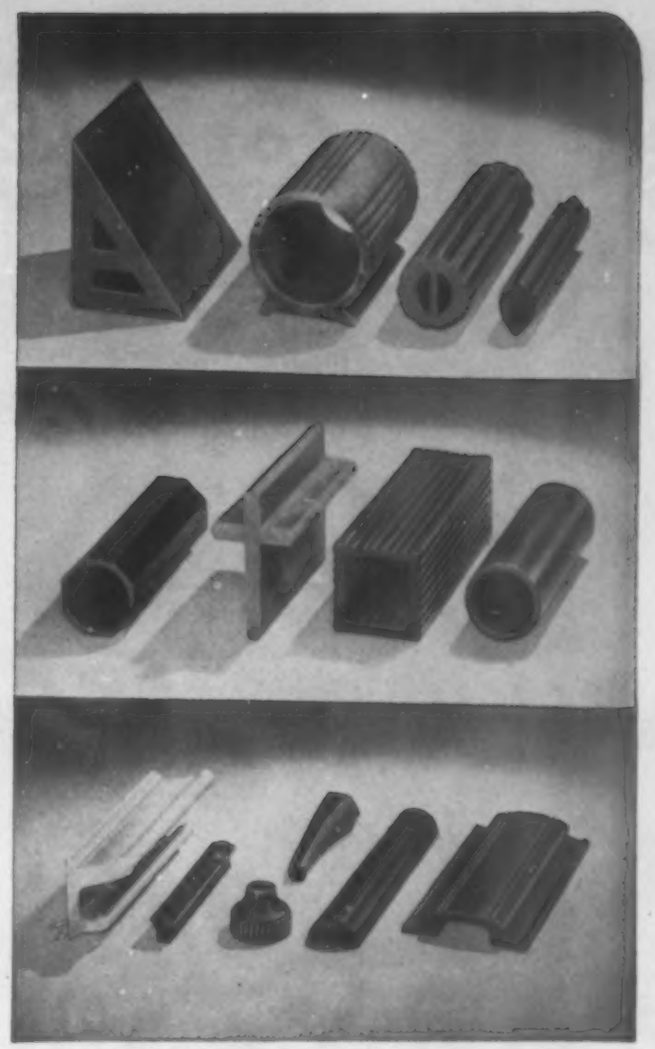
MARBLETTE

THE *Versatile* PLASTIC

A CAST PHENOLIC RESIN OF EXCEPTIONAL QUALITIES

- Outstanding among plastics, Marblette has a jewel-like depth and a complete color range which duplicates the appearance of precious stones, tortoise shell and ivory.
- Its almost infinite variety of colors is available in transparent, translucent, opaque, or in mottled effects. Marblette also comes in a waterclear form known as "Crystle" in a wide choice of colors.
- Marblette's machining characteristics, resistance to oil and acids, non-inflammability and exciting beauty make it ideal for countless manufacturing needs.



A few of the many types of Special Marblette castings made to customer's specifications.

SPECIAL CASTINGS

Marblette is supplied in sheets, rods, tubes, and special castings such as cutlery handles, kitchen utensil handles, pipe stems, cigarette holders, clock cases, automotive trimmings, jewelry items, buckles, etc. Special shapes made to customer's specifications can be supplied provided draft is all one way.

MARBLETTE LIQUID PHENOLIC RESINS

Casting Resins for Forming Dies and Tools

Metal Casting Sealing Resins

Bonding Resins

Low Pressure Laminating Resin

Bristle Setting Cement

Laminating and Insulating Varnish

Clear Phenolic Lacquer

MARBLETTE WILL HELP PLAN YOUR WORLD OF TOMORROW

The Marblette staff of engineers offers its services to help with your manufacturing problems. Write to us outlining your needs.

THE MARBLETTE CORPORATION

Manufacturers of Phenolic Resins Since 1929

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Metaplast Processes
for METAL DEPOSIT ON PLASTICS

Metaplast COMPANY
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METAPLAST PROCESS PATENTED AND LICENSED

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METAL PLATING ON PLASTICS

Extend Life of Molds Improve Product Quality Increase Production

with MEGATHERM* ELECTRONIC HEATERS

The uniform heating and complete plasticity of plastics preforms achieved by Megatherm result in substantial advantages to the entire molding process.

Pressures are drastically reduced . . . from 25% to 30% . . . smaller presses may be used . . . there is less down-time . . . there are no flow marks.

This adds up to longer lasting molds and dies . . . better looking and better quality product . . . an increase in production . . . more customer satisfaction.

The illustrated switch case produced by American Insulator Corporation of New Freedom, Pa. shows the product superiority achieved by Megatherm preheating. This intricate part made from rag-filled Melmac weighs 7 pounds . . . measures 15½" x 9" x 3½". It has 20 metal inserts . . . was molded to exact dimensions and flawless finish under 300 ton pressure. The cover weighing 3 pounds was molded of Durez No. 791 under 200 ton pressure.

Extend the life of your molds . . . improve the quality of your product . . . increase your production — with Megatherm. Write for details *now*.

3 KW Megatherm Unit in the plant of the American Insulator Corp., New Freedom, Pa.

FEDERAL TELEPHONE & RADIO FTR

Federal Telephone and Radio Corporation

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AN IT&T ASSOCIATE

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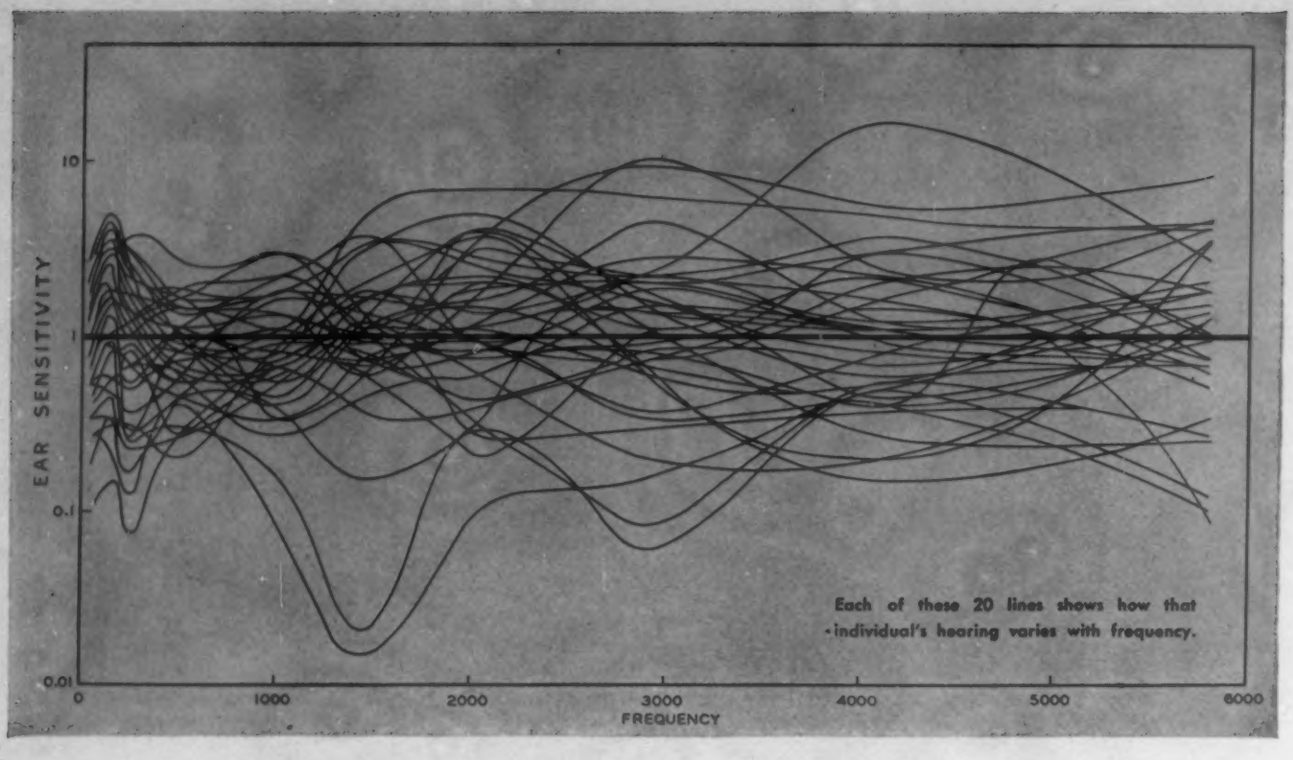


To measure is to know

Twenty-five years ago, one standard of sound power was the ticking of a watch, another was the clicking of two coins; and the measure was how far away the tick or the click could be heard. That test was made in measuring people's hearing, a field of interest to the Bell System scientists because the ear is the end-point of every talking circuit.

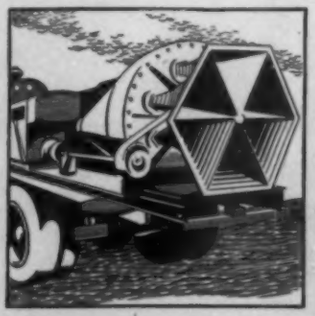
Accustomed to exact measurements, Bell scientists proceeded to develop a method of measuring hearing-sensitivity in terms which could be precisely defined and reproduced. After plotting hundreds of runs like those above, they decided on a particular sound intensity, representing an average "threshold of hearing," as a starting point.

The sounds delivered by a telephone line had previously been evaluated by listeners who compared their loudness with that of a standard source. There were wide variations in ears, as the chart shows, so the engineers replaced them by electrical instruments. When later their associates developed the Western Electric radio and public address systems, the necessary measuring circuits were promptly forthcoming. Addition of a standard microphone made a noise meter, widely used in quieting airplanes and automobiles.

"Through measurement to knowledge," said a famous Netherlands scientist. The principle finds wide application in Bell Laboratories, whether the quest be for a way to measure sound, a new kind of insulation, or more economical telephone service.

Hearing was first measured reliably by engineers in the Bell Telephone Laboratories

For good reception, program loudness must stay within certain limits. Volume-meters help to hold it there



From the throat of this mighty air-raid siren comes the loudest sustained sound ever produced

Visible Speech, result of telephone research, turns sound into "pictures" that the deaf can read

BELL TELEPHONE LABORATORIES

Exploring and inventing, devising and perfecting for continued improvements and economies in telephone service

BIG CABINETS
combined with
BIG PRODUCTION

Central location affords overnight delivery to radio manufacturing centers.

Painting operations performed on cabinets in our own plant.

By incorporating Radio Frequency heating and Automatic Controls, large daily volumes are being realized on the illustrated 3¾ pound plastic cabinet being molded for the Crosley Corporation's new postwar line. Quality, delivery and uniformity are assured in this new, large molded cabinet.

INTERNATIONAL's facilities are at your service with meticulous supervision of details that will please you. For complete engineering and molding service we invite your inquiries.

INTERNATIONAL MOLDED PLASTICS, INC.

4387 WEST 35th STREET, CLEVELAND 9, OHIO

WITCO STEARATES

ZINC · CALCIUM · BARIUM · MAGNESIUM · ALUMINUM

Exceptionally pure and of an even, fluffy texture. Produced by a special method under rigid control using only high quality Witco Stearic Acids. Preferred by many molders as a completely reliable dusting material and mold lubricant. Samples available on request.

WITCO CHEMICAL COMPANY

MANUFACTURERS AND EXPORTERS

[Formerly Wishnick-Tumpeer, Inc.]

295 MADISON AVENUE, NEW YORK 17, N. Y. • Boston • Chicago • Detroit • Cleveland • Akron • London

Adding Beauty to Utility in the modern car's ensemble – with

ERIE RESISTOR

custom molded plastics

In the keen competition for after-war customers, with performance so closely matching performance, alert automobile manufacturers are paying increased attention to the little spots of beauty that add so much to attractiveness while adding little or nothing to cost. Naturally, Erie Resistor, pioneer in injection custom molded plastics, is in the forefront in its cooperation with car builders; in the production of parts as designed by the manufacturer; in suggesting changes in design for improvement of the finished product or for its more efficient production; and in suggesting parts that can be made of plastics, with increased economy, or utility, or beauty, or all three.

Manufacturers in other fields, too, making everything from cosmetics to washing machines, are turning to Erie Resistor for help in package and parts design and molding; for the achievement of a sales appeal that begins with the dealer's store, and lasts for the life of the product.

Whether your thinking has arrived only at the stage of wondering whether plastics may be the answer, or of complete specifications of what you want, don't hesitate to write.

Plastics Division

ERIE RESISTOR CORP., ERIE, PA.

LONDON, ENGLAND · · TORONTO, CANADA

PLASTICS MAKE A BETTER WORLD

SPI

Invites you to attend

The National Plastics Exposition

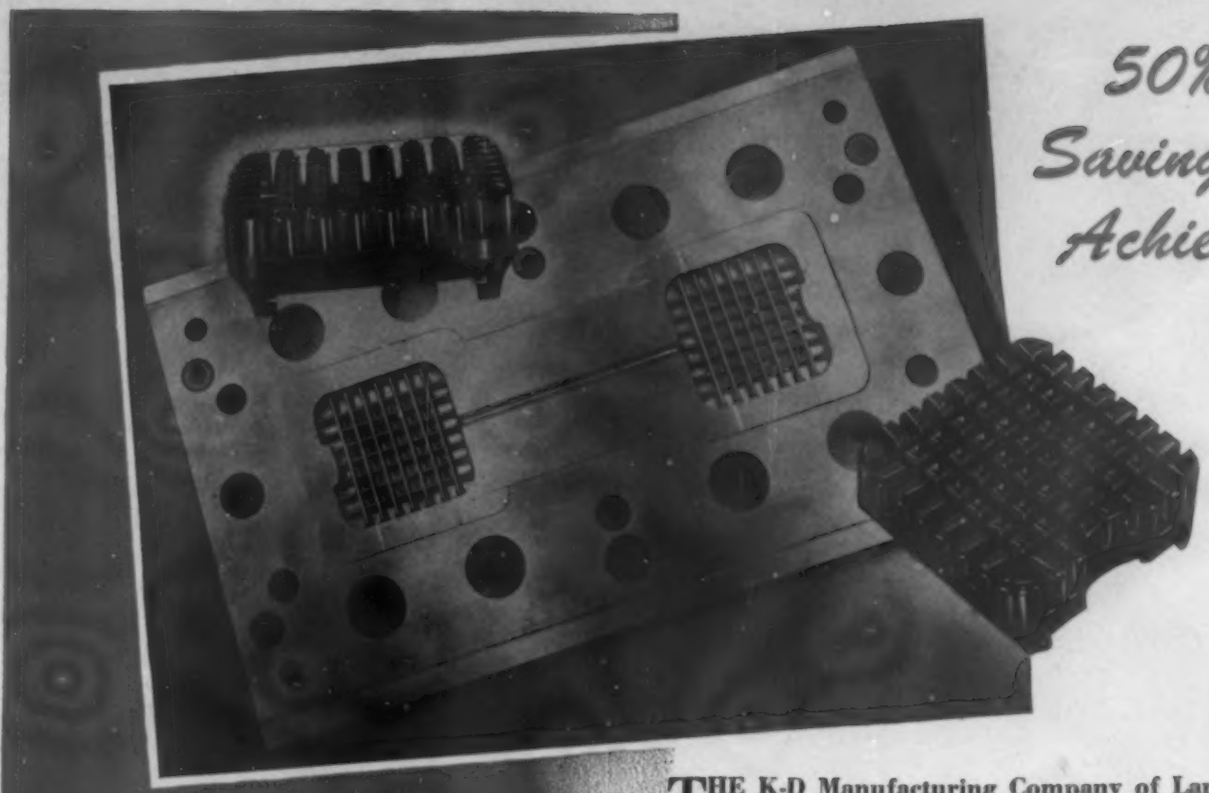
- SPI earnestly invites you to visit the first National Plastics Exposition, a brilliant pageant of the modern plastics that are playing an increasingly significant role in product development in virtually every American industry.
- The National Plastics Exposition will tell the whole story of all the plastics, what they can do for you, how they can do it. Everything in plastics will be paraded at the exposition by the industry's foremost materials manufacturers, machinery builders, fabricators, molders, extruders, laminators, service organizations—for you to inspect, test, compare.
- For new approaches to your product problems, for fresh ideas, for authoritative information about the developments that can mean greater volume and profits for you—visit this most significant and exciting industrial exposition ever held!

NATIONAL PLASTICS EXPOSITION

GRAND CENTRAL PALACE. NEW YORK

APRIL 22 to 27, 1946

Sponsored by the Society of the Plastics Industry



50% Saving Achieved

THE K-D Manufacturing Company of Lancaster, Pennsylvania formerly used a metal anvil on their popular fruit dicer widely used in hotels, restaurants and institutions. Looking for means of improving their product and reducing costs suggested the possibility of a plastic anvil. The rough metal anvil required milling of slots, machining the undercut, cleaning and polishing, plus the fact that porosity was not a satisfactory factor.

They brought their problem to us here at LANCE and together we went to work. The result is the two-cavity mold pictured above, with two views of the plastic anvil now part of the K-D fruit dicer.

This cam-operated mold allows the undercut to be molded in the initial operation. Machining, cleaning and polishing are eliminated and porosity is absent. The result is a 50% saving for the K-D folks . . . another example of how plastics can be applied to do things better—and more economically.

We'll welcome the opportunity to discuss any plastic or metal-plastic job with you, and you can be assured we'll be the first to tell you if plastics don't appear to be indicated as a solution to your problem. Call on us!

Complete
METAL-PLASTICS
Facilities

ENGINEERING

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SCREW MACHINE PRODUCTS

METAL STAMPINGS & ASSEMBLIES

LANCE Manufacturing Company

FIFTH and COURTLAND STREETS • PHILADELPHIA 40, PENNA.

IS YOUR PRODUCT IN GOOD SHAPE?

We mean that literally . . . is it plain, or does it have complex angles that might be difficult to mold? The *Winner Process* of low pressure lamination enables us to take the odd shapes as well as the simple ones.

ALWAYS PICK A WINNER

At present, the majority of our production is being devoted to large plastic products including a full line of boats, airscoops for giant airliners, deep sea devices, furniture and many other articles demanding specialized engineering techniques.

Consult us about your product . . . perhaps we can make it a *Winner* . . . in plastics.

WINNER PLASTICS

DIVISION OF WINNER MFG. CO., INC., 200 RAILROAD AVE., WEST TRENTON, N. J.

MULTIPRESS *Does it Again!*

CUTS COST OF CLEANING CASTINGS

At the
UNIVERSAL CASTINGS CORPORATION

Small castings of close tolerance are cleaned with low-cost efficiency on MULTIPRESS, with the high accuracy indicated in these "before and after" illustrations.

WITH its remarkably easy and *exact* control of smooth oil-hydraulic power—in amazingly rugged and compact form—MULTIPRESS continues to cut costs, boost output and improve quality on production jobs of every sort.

MULTIPRESS is shown above in action at the Universal Castings Corporation (Capaco Process) in Chicago, where it is specially tooled to clean plaster-molded aluminum, brass and bronze castings. The close tolerances and smooth finish of these castings emphasize the need for precision in the cleaning operation. The firm reports that these MULTIPRESS units have brought marked savings in their cleaning department.

MULTIPRESS users in many other fields have cited facts and figures showing greatly reduced "down time" for maintenance and tooling setups . . . drastic reduction of noise . . . lowered fatigue for operators . . . increased safety . . . lower initial tooling investment . . . important savings in floor space . . . and other production advantages.

A wide choice of models in 4, 6, and 8 ton capacities, with either manual or automatic cycling controls, offer an exceptionally wide range of Multipress ram actions. Standard accessories for further Multipress adaptability include straightening fixtures, extension tables, bolster plates, indexing tables—and the sensational new Vibratory Ram Action, providing short, uniform, closely regulative strokes at frequencies up to 500 per minute!

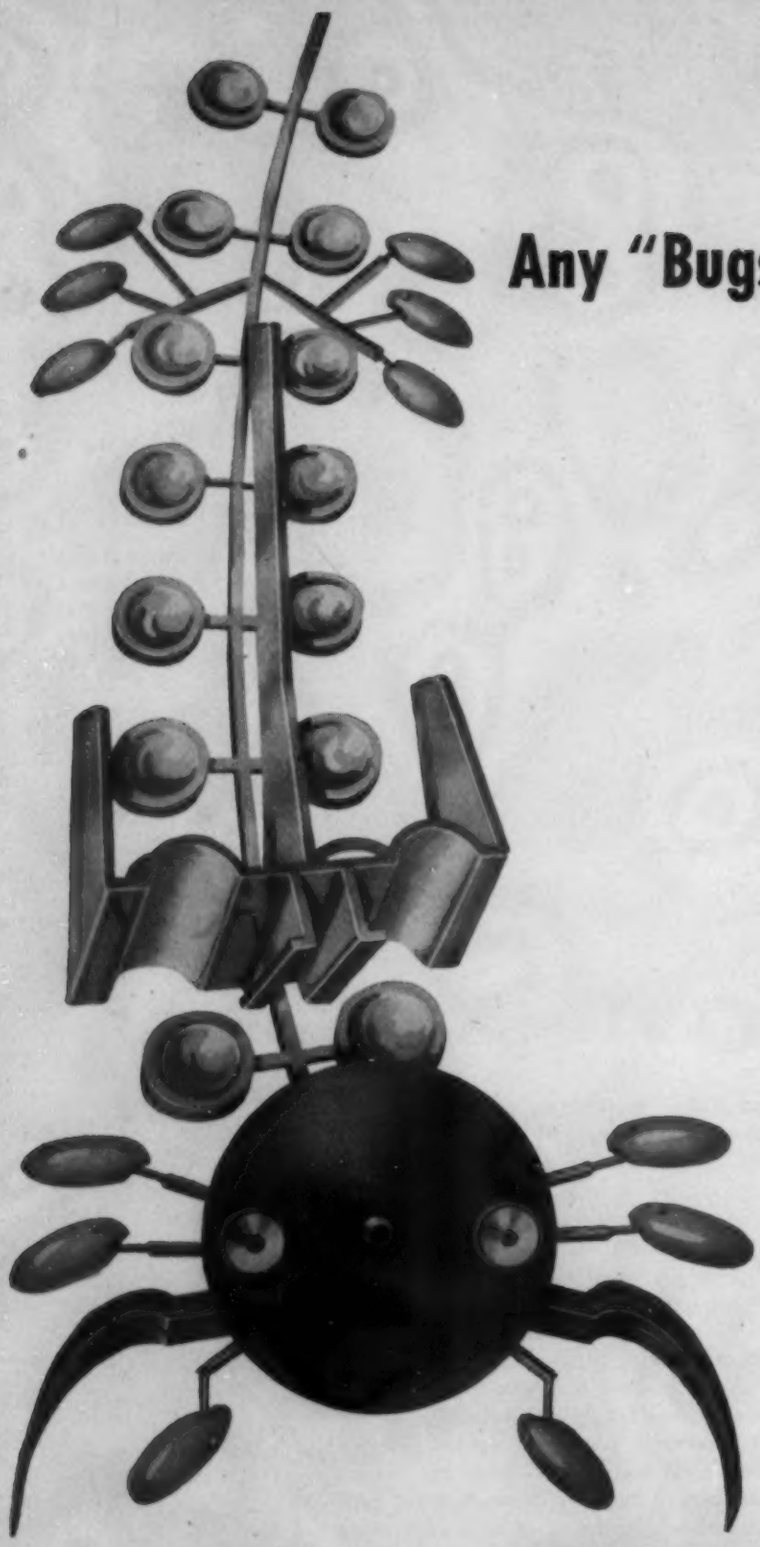
Write today for latest complete details on MULTIPRESS.

THE DENISON ENGINEERING COMPANY

1176 Dublin Road, Columbus 16, Ohio

FLEXIBLE POWER PLUS ACCURATE CONTROL

DENISON EQUIPMENT for APPLIED HydrOILics



Any "Bugs" in your Product?

If there are, you don't have to send out "feelers" to see if we'll help you out. Exterminating the "bugs" in new products is a job that Continental's Plastics Division is often called on—always glad to do.

Bank on it—our staff of engineers, designers, researchers, is well-equipped to untie your knottiest problem. Long years of experience in working out new products for some of America's best-known manufacturers has given them the necessary plastic "know-how."

The insect alongside shows several examples of Continental's plastic magic. His body is made of flashlight lenses . . . the feet are fishing lures . . . the wings are acid baffles . . . the claws are coffee maker handles . . . the head is a distributor and coil part.

But the list is endless. Set all the plastic items we make on paper and they'd fill this page. Best thing about it, each new day brings a new use. Perhaps plastics and Continental's plastic engineers can help *you* improve or develop your product. Why not drop us a line?

Tune in: "CONTINENTAL CELEBRITY CLUB"
every week over coast-to-coast CBS Network

OTHER CONTINENTAL PRODUCTS: Metal Containers • Fibre Drums • Paper Cups • Crown Caps and Cork Products • Machinery and Equipment.

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FIGHT INFANTILE PARALYSIS • JAN. 14-31

CONTINENTAL CAN COMPANY, INC.

PLASTICS DIVISION

HEADQUARTERS: Cambridge, Ohio
Sales Representatives in all Principal Cities

COMPRESSION • INJECTION • EXTRUSION
SHEET FORMING • LAMINATION

YOU WIN WHEN OUR "PAPEROLOGISTS" PUT "*Mosinee*" TO WORK FOR YOU!

MOSINEE, as a product material, continues to meet many product-engineering and production requirements, where improved quality and greater utility must be linked with lower costs, to win new markets or expand present fields. To "make the most of paper", engineered as part of your product . . . or your packaging...it pays to put Mosinee "paperologists" to work. With broad experience, extensive laboratory facilities and efficient production methods at their command, they can establish controls that assure definite dielectric strength, uniform density, specified maximum-minimum pH, moisture repellency, high tensile strength, and other technical characteristics which help make products winners!

A conference between the "paperologists" of The Mills of Mosinee and your management, product engineers, production and sales executives, should prove constructive. MOSINEE is ready.

MOSINEE PAPER MILLS CO. MOSINEE WISCONSIN

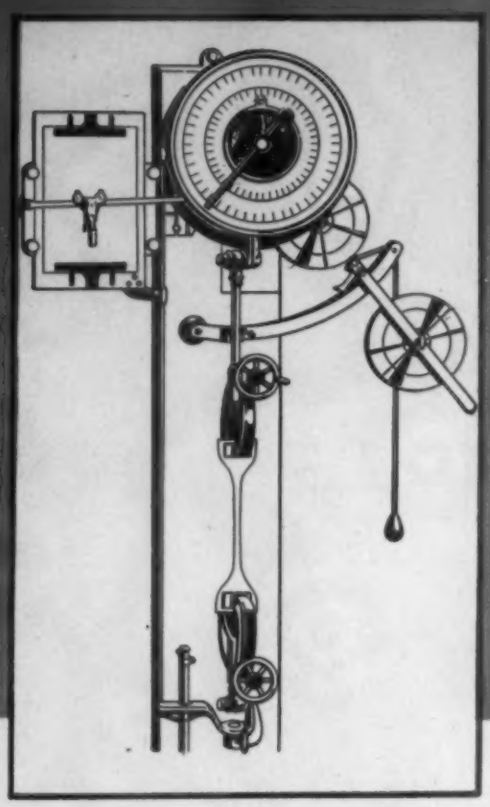
Please address your letter "Attention Dept. A"

MOSINEE PAPER MILLS COMPANY
MOSINEE • WISCONSIN

Essential Paper Makers

For Plasticizing Buna N···

EMERY'S PLASTOLEIN X-348



LOW HEAT LOSS
COMPRESSION SET
COST

HIGH ELASTICITY
RECOVERY
TENSILE

Emery's Plastolein X-348 has been evaluated in Buna N compounding to prove its worth as a *primary* plasticizer for mixes containing all, or a high percentage, of this type of rubber. Typical results prove that X-348 has many advantages over other plasticizers without gaining them at the expense of other valuable characteristics. X-348 is also compatible with nitro-cellulose, ethyl cellulose and to a limited extent with the vinyls.

Samples for laboratory evaluation and moderate commercial quantities both are immediately available. Write for complete information showing comparative evaluations.

PLASTOLEIN X-348

is a low-cost *primary* plasticizer and because of its low price does not require a secondary plasticizer to make its use economical. On any basis it compares very favorably with any plasticizer in these fields. Its excellent aging characteristics are proved by the retention of over 60% of the initial ULTIMATE elongation after 70 hours at 250° F.

EMERY INDUSTRIES, Inc.

STEARIC ACID • OLEIC ACID • ANIMAL, VEGETABLE AND FISH OIL FATTY ACIDS
TWITCHELL PRODUCTS • PLASTICIZERS

4300 CAREW TOWER • CINCINNATI 2, OHIO

3002 Woolworth Building, New York 7, N. Y. 187 Perry Street, Lowell, Mass. 401 N. Broad Street, Philadelphia 8, Pa.

MODERN PLASTICS
VOLUME 23 FEBRUARY 1946 NUMBER 6

There's a big market in premiums

The making of plastic sales aids was big business before the war. It will be bigger . . . as soon as materials, molds, facilities and new ideas are ready

WHEN premium buyers and advertising men look around the exhibition of sales aids at their convention in Chicago next May they'll probably find that the plastics industry's contribution to their business, in point of variety, color, design, utility and quantity of goods, will have increased tremendously over prewar levels. This means that even if the 1946 volume of premiums, prizes and advertising specialties does not exceed the 500 million dollar level (at manufacturers' prices) which it reached in 1941, plastic products will account for more than the 25 million dollar business enjoyed from premiums in that year.

Frank H. Waggoner, editor of *Premium Practice and Business Promotion* for the past 37 years and one of the foremost authorities in the field, states that when competion sets in, when goods are flowing freely again, premium merchandise can pass 600 million dollars in volume annually and he believes that plastic products can reasonably hope to represent 10 to 15 percent of that amount, or 60 to 90 million dollars. That's really Big Business, by any standard!

Readers will note the terms *probably* and *reasonably* in above statement. A big *IF* is implied—and meant, for plastic sales aids never before commanded more than 5 percent of the market. Whence and how is the big increase to come? Such things don't happen by accident. What is the big *IF* that must be overcome? And who must overcome it?

The answers can't be given in a few words. There are many factors involved—business traditions, advertising methods, consumer buying habits, past misunderstandings and present prejudices. And the combined efforts of plastic processors, premium buyers and advertising executives are required if they are to be overcome. This article hopes to expose the elements comprising this uncertainty, to show how they may be overcome, and to prove that such action will be to the mutual advantage of the plastics industry and the advertising profession.

PREMIUM MEN SAY . . .

"We look for the largest use of plastics as premiums that the industry has ever encountered, beginning just as soon as molders get raw materials in quantities large enough to meet the huge requirements."

Frank H. Waggoner, ***editor***
Premium Practice and Business Promotion

"We keep an open mind toward all materials. During the war it was difficult to get good premiums, impossible to get some. Now we're in hopes of getting quality merchandise in variety again. How many plastic items we'll use will depend on the plastics people. We're open to suggestions."

M. H. Richards, ***premium buyer***
Colgate-Palmolive-Peet Co.

"Plastics for premium manufacture will have more competition from light metal, glass and possibly wood than ever before. But the plastics industry has developed more know-how, and that, added to a practical approach to merchandising, should give it a new advantage."

Duane Jones, ***president***
Duane Jones Co.

Types of sales aids

First, let us analyze the sales aid business and study some of its past uses of plastics. There are three main sections: premiums, advertising specialties and prizes. Even though the same product may sometimes be used in all of these three sections, the applications are not to be confused.

Premiums—A product is classed as a premium if it is offered in return for coupons, box tops, a letter to an advertiser, a trip to a store, a service rendered, a special

FAMOUS PLASTIC PREMIUMS THAT RAN INTO MILLIONS

PHOTO, COURTESY TENNESSEE-EASTMAN CORP.

Hi-Yo! Silver!—and the Lone Ranger tears away from the scene where he saved the damsel from distress. Over the air he offered this Lone Ranger whistle to kids who followed his program, and he was swamped with replies. Molded in three parts from cellulose acetate, the whistle is an excellent example of a specially designed premium. When offered, this whistle was not available anywhere else at any price. That is the secret of self-liquidating premiums

PHOTO, COURTESY CELANESE CORP. OF AMERICA

The famous Frigidaire bank was used as a premium in selling refrigerators on an installment basis. The purchaser was thus encouraged to save money which had previously been spent for ice, using this to pay for the refrigerator. The miniature replica was made to scale and molded of cellulose acetate. The production ran into hundreds of thousands. The premium was so popular that it was often used long after the purchase had been paid for

purchase or any of these plus a small piece of cash. It is an inducement to buy; it involves effort as well as an outlay on the part of the customer.

Advertising specialties—These sales aids are straight goodwill promoting gifts, requiring no effort or outlay from the customer.

Prizes—These aids require no expenditure of money but do demand effort. They are not a big factor.

Eight premium approaches

Premiums are classified according to the advertising appeal which determines what they shall be and how they will be distributed. Here is a simple breakdown:

1. Coupon and discount stamp exchange premiums—This classification embraces a wide range of utility merchandise generally offered through a catalog and frequently distributed in exchange for coupons at premium stores operated by company using the plan.

Colgate-Palmolive-Peet Co. offers merchandise in exchange for coupons from packages of its own Octagon soap products, Borden's Silver Cow milk, Ballard and Ballard's Obelisk flour, Rumford's Hearth Club baking powder and Wm. B. Riley's Luzianne tea and coffee. The Colgate premium catalog, even in its wartime edition of 1945, featured 214 items ranging from aprons to razors, from Bibles to wallets. Thirty-five of these articles were made entirely or mostly of plastic.

The Sperry & Hutchinson Co., which operates a system of promoting cash business for retailers known as the Green Stamp plan, uses a catalog as well as extensive display in a big chain of its stores where stamps are redeemed for premiums. It offers nearly 500 items. Almost all of these premiums are nationally branded merchandise, including many that have some plastic components.

2. Purchase privilege premiums—Under this plan, which can be made to pay for itself, the purchaser of a product, such as a package of tea, is given the opportunity of buying another product, such as a teapot, for considerably less than the retail price of the premium product. It is not necessary for the product and premium to be related. A famous example was the purchase privilege sale by Coca Cola Co. of over a third of a million electric irons in metropolitan New York in boosting its retail sales by the case.

3. Combination sales of product plus premium—In this case the purchaser is given no option. She buys, say, a package of flour and a cake knife for one flat price and generally for a limited time only.

4. Package premiums—These are generally handled as standard gift additions to packages by the firms using

them. Johnson's Wax in prewar days was sold with a plastic key chain bracelet attached to the package. As gift premiums, they may or may not be related to the products they accompany, and sometimes they fill unusual purposes, such as the Frigidaire savings bank, a plastic miniature used by those who purchased Frigidaires on time to save ice money with which to pay for them.

5. Premium containers—Stationery may come packaged in handkerchief boxes; men's belts in cigarette boxes. Container re-use is the big idea here.

6. Self-liquidating offers—This is the big field for small items, where the premium deals are generally offered in radio commercials. For a box top and a dime, a quarter or even 75 cents mailed in to the advertiser, the consumer receives a premium which she either could not buy at retail or which would cost her more in the stores. The self-liquidating feature means that the advertiser breaks even on his purchase and sale of the premium, paying for it and the postage about as much as he gets in cash for it. Examples of successful plastic premiums in this category are legion. Readers are referred to MODERN PLASTICS for April 1944.

7. Gift mail-in premiums—In certain cases, advertisers offer a premium in return for nothing more than a box top, usually for the purpose of gaging consumer acceptance of advertising or audience reaction to a radio program. The Pepsodent bathroom tumbler, made of urea-formaldehyde, was a good example of this classification.

8. Combinations and variations of the above classifications—A deal may start out to be a time-limited self-liquidating proposition and end up as a permanent offer, frequently under the guise of a combination sale or a package premium. In such cases the advertiser patents the idea and then proceeds to tie his merchandising plans to it.

Plastics role in premiums

Now, with this classification as a background, we can go back and see the part plastics play in the premium field. We can also define present trends and estimate their probable effects on the market.

It can readily be seen that plastic premiums fit all the 8 categories into which this sales aid was divided. But, historically, they performed best as package premiums, combination sale of product plus premium items, self-liquidating premiums and gift mail-in premiums. Not a few started as self-liquidating premiums and ended up as combination sale premiums in permanent merchandising plans, or became standard merchandise for both retail sale and coupon premium use. The famous plastic premiums, six of which are shown on this and the preceding and following pages, prove that when plastic premiums are good, they can't be beaten as salesmen.

Then where is the big *IF* that shadows the increased use of plastics in premiums? Here is factor 1—to be successful, plastic premiums have to be *good!*

Good as it relates to premiums has a number of mean-

When Wheaties were first introduced several years ago, this premium, the Skippy Bowl, was given free with two packages of the cereal. One molder, using a $20,000 mold and 720,000 lb. of urea-formaldehyde, turned out over 6,000,000 bowls which the advertiser paid from 5½ to 7 cents apiece. Twenty-four bowls were packaged with 48 boxes of Wheaties in a carton which grocers could handle very easily. The merchandising tie-up is shown in the above illustration

This Bab-O container was specially developed by a molding company whose engineers worked on the design with the material manufacturer. Over 3,000,000 of these containers were turned out in a variety of colors in urea-formaldehyde. Started as a 3-month premium promotion to expand sales, it proved so popular that production ran steadily for 2 years. The household cleaner manufacturer offering these containers was one of the first companies to use premiums

FAMOUS PLASTIC PREMIUMS THAT RAN INTO MILLIONS

American Home Products once introduced a line of baby food by means of this cooking timer, made of cast phenolic. The timer was made of sliced rod stock in red and yellow, the glass centerpiece being half filled with blue sand. In the past there were comparatively few fabricated plastic premiums. Now new materials, new automatic machinery and new methods make possible mass production of fabricated items and more will be used as premiums

When Little Orphan Annie was the character around which an Ovaltine promotion centered, a urea-formaldehyde mug was designed as a premium for the account. It was produced in millions and enjoyed great success. Later on, the advertiser wanted to develop a wider market for his product served cold, and a shaker of the same material was made, with equal sales success. Both these items were created to meet the requirements of the premium field

ings. In the first place, the most successful applications of plastic to premiums have been in self-liquidating offers, where there was an element of newness and glamor to be featured in radio commercials and advertising copy, where the quantities ran into the millions and where a clever idea or design counted heavily. Plastics had the advantage of newness to help them fill the bill. But, now, plastics are no longer new. They must depend instead upon the three other elements which make for *good* premiums—that is, beauty, utility and/or novelty.

What makes a good premium

Duane Jones, the "Box Top King," head of the advertising agency of the same name, directs the distribution of over 3 million premiums a year for such accounts as Bab-O and lines of packaged foods. He points out that since 1851, when B. T. Babbitt invented the premium idea by giving away pretty pictures as a means of introducing his packaged soap, premiums have run the whole gamut from pieces of the Blarney Stone through genuine fox tails for kids to tie to their bicycles, to really beautiful household utility devices. And among the big volume jobs, the spectacular successes, there were quite a number of plastic products.

Here is Duane Jones' list of desirable qualities in self-liquidating premiums, with comment on how plastic premiums fit the picture. In essence they are the "beauty, utility and/or novelty" qualifications which were set up as essentials to success in this field.

1. A perfect premium is based on a clever idea. Standardized gadgets, of plastic or any other material, will not hit the big time, although they may become coupon premiums. If the idea is not *new*, it must possess other advantages that will compensate for newness in advertising and radio commercials. After all, these items are frequently "sold" to the public sight unseen.

> Plastics lend themselves exceedingly well to new design. They have color, texture and ability to take style shapes.

2. A self-liquidating premium must be available in test quantities first. Customary practice is to try out an offer in a fairly tough territory for a few weeks before making a national offer. Possibly 25,000 pieces are needed for the trial. If the results are good, orders varying between 400,000 and 1,000,000 may be

placed. If the premium is that good (and plenty of plastic premiums have been) additional orders for more millions may be placed.

If the premium is plastic, single-cavity molds or, in the case of fabrication, a limited number of jigs may be used on the trial run.

3. It must have a universal appeal for *housewives*. Women are the big market for soaps, foods, dentifrices and other things sold with premiums. An exception to this rule is the children's premium market. But even here it is preferable to offer something that will appeal to both boys and girls in a wide range of ages. Care must be exercised to make sure that the premium is not offered to a market already saturated with premiums. In most cases, the premium buyers and advertising agencies have methods of surveying the consumer markets in order to determine this very question.

Plastic premiums are particularly acceptable for household use when specially designed for the purpose. There are 34 million homes in the United States; all have kitchens, most have bathrooms. And plastic premiums are naturals for both the kitchen and the bath, because of their qualities and because of public acceptance.

4. It must be worthy and useful. Remember that the product leans on the premium, not the premium on the product. It must be no more expendable than a premium of the same price made from light metal, glass, crockery or other material.

The fact that so many products which began their careers as premiums are now standard retail merchandise proves their worth and usefulness.

WHAT ABOUT AD SPECIALTIES?

"There is a place for plastic advertising specialties in every price range. Just remember that they must have dignity and usefulness and be designed to carry a printed or stamped sales message. New ones are always needed."

Eugene A. Behr, *president*
Advertising Specialty Associates

5. It should be exclusive. For real punch in a premium offer, the product should not be available anywhere else and, for at least six months after the offer is cancelled, should not be offered at retail at less than twice the "price" that people paid for it when it was a premium.

This takes us back to the design angle and to the constant cry of the premium buyers, "Bring us an idea." The best design creations for plastic materials can only be achieved by experts in plastic processing.

6. It *should*, if possible, tie in with a fad or outstanding news event. The recent Freedom Sword Pin premium, issued by Duane Jones, is an example. It was a miniature replica of the sword presented to General Eisenhower by the Lord Mayor of London not so long ago, and it immediately caught women's fancy.

It is quite as feasible to tailor a plastic premium to a made-to-order market as it is a premium of another material. (*Please turn to next page*)

Good advertising specialties of plastics include desk pads, thermometers, an eye particle remover, a nickel-bank key chain, letter openers, thimbles, automatic pencils. All are useful and well made

Colgate-Palmolive-Peet Co. features these plastic items in its long list of premium merchandise offered in return for coupons available with its own and other manufacturers' products. Included in the picture is the well-known phenolic ocharina. Originally the company bought these in Europe but when a plastic instrument was developed in this country a switch was made to the new product which met with success

How to assure a plastic market

There is the list. At this point it appears that plastics are perfect materials for good premiums, and as soon as materials and molds are available the field will automatically more than double itself. Whether it will or not depends upon the cooperation or lack of it between premium buyers, advertising agents and plastic processors. The past successes of plastics premiums have been due in no small measure to continued interest of all these men, beginning with the creation of the design and continuing through the mold construction and material selection to the production itself.

Rather than draw out the pros and cons we here present a list of things that must be done if plastics are to be assured a substantial place in the premium field, with allocation of responsibility, based on a good number of interviews:

Design—The advertising agent must lay his cards on the table and name the account that wants the premium. Otherwise the plastic designer is either fishing for an idea in the dark or may have suspicions that the buyer intends to shop around for a better price on the production job.

The processor must recognize the fact that premium manufacture is creative work, not necessarily custom molding. He must be equipped to create ideas, engineer original designs and merchandise them if he wants this business.

Mold and development costs—Who pays for the development? Who pays for the molds? And when? The habit of custom molders is to accept payment for a mold when it is okayed for production. The desire of many premium buyers is to amortize the cost of the mold over the prices on the first big run. Yet, because there must be little delay between a successful trial and the main national premium offer and because multicavity molds take weeks to produce, the job must be started. Advertising agencies, premium buyers and plastic processors must work out a method of financing development work in which the risks are shared.

Cost of premium—If a premium is to be worthy, it will cost more than an expendable gimcrack. It will

The combination requirement of utility plus beauty in premiums and advertising displays is apparent in this assortment of additional plastic items offered by the Colgate company. Every piece shown here has both qualities. The products look well in catalog illustrations or on displays and they will stand up very well in service

have to be properly made, out of the right material. Premium buyers must realize that "can we make it cheaper in plastics?" is no sound criterion of purchase, but should be "can we make it better in plastic?"

In any material, a good premium will cost more than a piece of junk! Plastic processors, going after this business, must be prepared to sell on this basis.

Advertising qualities—The processor should consult with the advertising agent over how the plastic premium is described in copy or radio script. Where a premium is to withstand household use, it should carry an informative label. It will be to both parties' advantage to see that these things are done since too few consumers know one plastic from another.

IF these things are done, the field for plastic premiums will be greatly enlarged. Good plastic premiums will be produced and sold by the millions. For plastics processing is a mass production proposition whose biggest prewar output was in low-priced quality items.

Printer's Ink Monthly, in its survey of premiums and premium plans for 1940, the last big year in this business, showed that the highest price set on a premium was 65 cents plus a Rinso wrapper for a 3-quart saucepan. There were a few offers involving the sending of 50 cents cash, many at 25 cents, a few at 15 cents. But most offers were set at 10 cents. Note that the mailing of a single coin is most desirable.

Advertising specialties

Now, let us consider advertising specialties, that is, straight goodwill-promoting gifts. According to Advertising Specialty Associates and Advertising Souvenir and Calendar Co., products for this field must possess the following qualities:

1. The big market is for office supplies, for premiums that can be used by business men, preferably at their desks, where purchasing decisions are made. There is also a big and growing market for items with appeal to housewives, and also a children's market.

2. They must be able to take the imprint of the name, address and sales message of the donor, either by stamping or application of decalcomania.

3. They must be light in weight to keep down the cost of shipment and handling. (*Please turn to next page*)

4. They must be clever enough in design to make an impression on the prospect. In most cases, this means that they must be designed especially for this field—not as an afterthought to the resale market. Ninety-five percent of the millions of dollars' worth of merchandise used in the advertising specialty field is manufactured solely for this purpose.

This field is wide open for new merchandise. Molders are currently millions behind orders on prewar-designed items. The business is starving for goods and for clever ideas.

Light weight, color, formability, adaptability to mass production all favor the use of plastics in advertising specialties. However, serious mistakes have been made in its use for this field in the past and should be mentioned here as a warning. Take, as examples, polystyrene combs with no flat surfaces, a fault which made them liable to shatter during the stamping process; letter openers and swizzlers that lacked strength.

Overbalancing these mistaken applications is the work of the many molders who, having specialized in these products, have developed their own lines of specialties and merchandised them in huge volume.

Thermoplastics hold the big interest in this field but many items made of urea and phenolic compounds and vinyl sheet are also used. Prices to the jobbers range from 2 cents to 2 dollars apiece. Here is a list of advertising novelties found acceptable at all times:

Letter openers, thermometers, six-inch rulers, drink swizzlers, memo pad holders, strong thimbles, desk calendars, pocket combs, desk magnifiers, key chain gadgets, matchbook cases, mechanical pencils, blotter covers, ash trays, long drink spoons, drink coasters.

The possibility for much larger volume is indicated by a recent swing to interest in export. It is quite possible that American plastic advertising specialties will soon be found all over the world, representing foreign as well as American companies.

Lack of materials and mold-making facilities are temporarily delaying new development in premiums and advertising specialties. But it is coming. To

Top: A recent entrant into the field of plastic premiums is this ash tray of urea or phenolic. It can be made with a name or trademark molded in by means of a removable tooled ring in the mold. Lower left: A new premium is this cellulose acetate table lamp the entire length of which houses a 15-watt fluorescent lamp. It emits a soft glow, with a maximum of light coming from the ivory translucent upper section. Below: Another new premium is a set of cellulose acetate birthday candle holders in pastel shades of ivory, pink, blue and yellow. Package is planned to carry advertising copy as well as informative labeling

PHOTO, COURTESY CELANESE PLASTICS CORP.

Plastics have served the American housewife well in the past. Indeed, several of the cellulose acetate kitchen utensils and servers, such as these salad forks and spoons, now accepted as standard, were premiums at first and became ordinary merchandise following introduction as premiums

date, goods for both markets have been largely molding propositions, because runs are tremendous and mass production was associated in the minds of buyers with molding. However, modern automatic machinery, improved techniques of fabrication and the use of new materials will make fabrication a bigger premium factor in the future.

A challenge to plastics

When they enter the premium field, plastic processors are accepting a challenge to improve and expand their own service and merchandising plans. And because there is nothing quite so good in the premium and advertising specialty fields as good plastic products—the increased use of this material in premiums is also a challenge to premium buyers and to advertisers—especially those having new products which are to be introduced on the market!

Credits

Lone Ranger whistle: Tenite, assembled by Chicago Musical Instrument Co., tube molded by Sandee Mfg. Co., bell and mouthpiece by Elmer E. Mills Corp.; Frigidaire bank: Lumarith; Wheaties bowl: Beetle; Bab-O container: Beetle, molded by Mack Molding Co.; Cooking timer: Catalin; Little Orphan Annie mug; Beetle, molded by Kurz-Kasch, Inc.; Desk pad: cellulose acetate molded by Minnesota Plastics Corp.; Eye particle remover: Lucite, molded by Allergy & Medical Products Co.; Nickel-bank key chain: molded by Plastic Manufacturers, Inc.; Table lamp: designed by C. E. Waltman & Associates, molded by Elmer E. Mills Corp. for All-Lite Mfg. Co.

PHOTO, COURTESY MONSANTO CHEMICAL CO.

Railroading in miniature

by J. L. BONNANO* and J. E. CURRIER†

Plastics are used extensively in model electric trains because of the accuracy with which they can duplicate the details of full-scale railroading equipment. Phenolics are also employed for their insulating properties, good impact strength and dimensional stability which are of importance in switch bases and transformer cases, and for their high surface gloss. Polystyrene is the material used in such applications as the Gondola car. It has the advantage of light weight and the ability to withstand the high temperature attendant upon the application of a baked coating of paint. Even more model plastic train parts are planned for the future.

THE youngster who turned aside from a model electric train because the number of uprights in the observation car railing didn't correspond with that of the actual train wasn't looking at one of the small-scale railcars produced by the Lionel Corporation. Realism is the theme of this company, a realism that extends to the use of the blueprints employed by the major railroads in the building of their rolling stock. After being scaled to plaything proportions, these prints are used as the specifications for the Lionel line of model trains.

But the best drawings are of no use if their detail cannot be reproduced exactly. That is why Lionel uses plastics for a great many of its products. It has found from years of experience that plastics of either the thermosetting or thermoplastic types give a combination of properties unobtainable in many other materials—light weight, impact strength, dimensional stability, good dielectric qualities, to name but a few.

Past, present and future

The Lionel Corporation's use of plastics really falls into three distinct catagories. First, there are the molded parts presently in production. This group should be supplemented, before long, by a number of new pieces of plastic model railroad equipment. Some of these will be designs never before produced by the company, some will be parts previously made from nonplastic materials. This second group overlaps somewhat with the third which includes uses in which certain types of plastics were found unsatisfactory as planned, necessitating change of material or design.

The preparation of blueprints for each of its model train parts is just the first step in this company's pre-

* Chief engineer, Lionel Corp.
† Technical representative, Bakelite Corp.

production schedule. Next comes the machining of a model from the plastic which has been selected as best suited for the application, a selection made in cooperation with plastic materials manufacturers.

If the model is satisfactory in the plastic specified, a single cavity experimental brass mold is then produced. This mold is used in conjunction with laboratory-sized molding presses of either the compression or injection type, depending upon whether thermosetting or thermoplastic material has been selected for the piece. Only after careful study is a full-scale commercial production mold turned out.

Established plastic parts

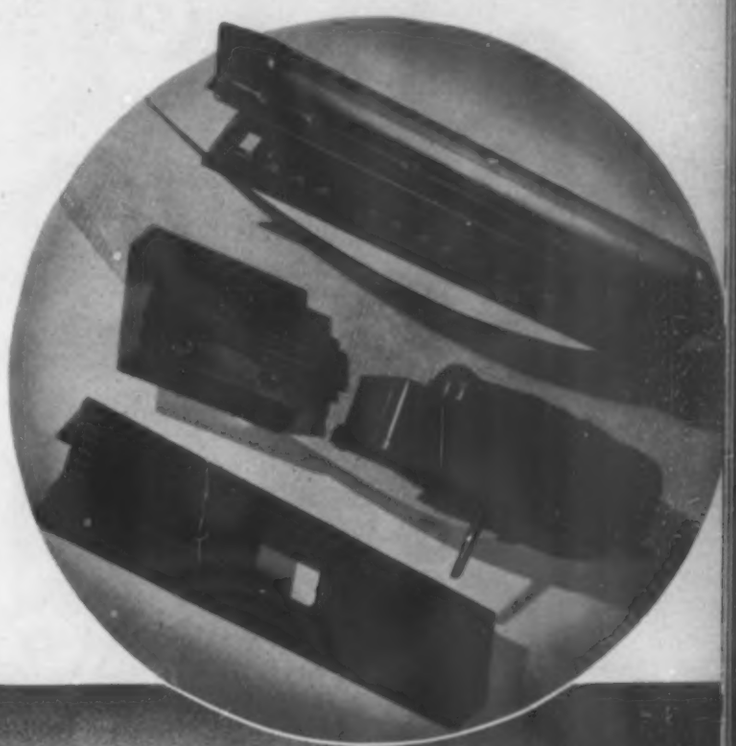
Switch and track bases—Switch and track bases are molded of general-purpose black phenolic because this material simplified the insulation problems. For added strength, Lionel designed these pieces with ribbing. The construction and material combine to produce parts that remain flat better than similar pieces made of other types of plastics.

Transformer cases and control boxes—The transformer cases, which are molded in two halves (Fig. 2), weigh $2^1/_4$ pounds. Phenolic molding materials with long fiber cotton flock content or macerated paper base were found to have good impact strength for this application and were superior in dimensional stability.

Black general-purpose phenolic was selected for the control boxes for whistle, remote and crane controls because it simplified the electrical insulation problems and yields a piece with high surface gloss at low price.

Pullman cars and commutators—Station platforms, log loaders and Pullman cars are also molded of general-purpose phenolic materials. The Pullman car, which measures 18 in. in length, is painted the color of the original railroad car for greater realism. Since the only other means of producing this car with equal authenticity would be through the use of die castings of metal, the adoption of plastics affects a three-to-one saving not only in cost but also in weight.

Commutators utilize phenolic molding blanks, for no other molding material could be found which had



1—Here are a few of the phenolic model train parts that are so largely responsible for the realism of the photograph on the opposite page. Pullman, coal car and truck sections duplicate the equipment of major railroads. 2—The use of phenolic materials with long-fiber cotton flock content in this transformer gives the case strength and stability, yet keeps it light enough to handle easily

2 ALL PHOTOS, COURTESY BAKELITE CORP.

comparable flexural strength when press-fitted onto a shaft. The list of applications for which phenolics are used also includes coil forms, laminated gear and switch swivel rails, to mention only a few.

Small thermoplastic parts—Thermoplastic molded pieces also play their part in the production on these miniature railroads. Head lights, running lights and the caps on transformer and switch controls are molded of transparent clear red and green polystyrene. The picket fence which adds to the realism of the miniature is injection molded of black polystyrene.

The Gondola car—Made from stamped sheet metal in previous production, this car (Figs. 3 through 5) is now produced from transparent polystyrene. It is injection molded, then painted, and baked at 160° F. to obtain a dull black finish which gives it authenticity.

Polystyrene was chosen for this intricate application because of its superior dimensional stability, light weight, adequate strength and the fact that, although thermoplastic, it can withstand this high baking temperature better than other thermoplastic materials tested by the company Then too, the use of polystyrene permitted sufficient wall thickness in the finished part, particularly at the ends, assuring scale accuracy. In a stamped sheet metal piece, such variations in thickness could only be achieved after numerous pressing operations, and then the parts would be of excessive weight.

3

4

3—The small-scale Gondola car is transparent as it comes from the injection press. The dull black finish is achieved by painting the polystyrene surfaces and baking at 160° F. 4—But using polystyrene for the Gondola, the manufacturer was able to achieve the proper wall thickness

Parts to come

Lionel's plans indicate that many other parts besides those just mentioned will be molded from plastics. The new station house (Fig. 6) is to have a roof molded of black general-purpose phenolic in a simulated tile effect which will be painted in order to obtain the terra cotta color desired. The base of this station is to be of the same material, molded to simulate planks.

As for thermoplastic materials, a new merchandising car as well as a box car will be molded of polystyrene. These proposed applications can be attributed to the success of the Gondola car. Other planned items include a tank car of polystyrene, injection-molded polystyrene window and door frames for the new station and station house windows of translucent vinyl resin sheet. Then too, the plug used on the transformer wire will be molded of vinyl elastomeric plastic in place of rubber. The wire itself will be insulated with a vinyl wire insulation compound.

Changes in material selection

Crane boom—Although Lionel considers itself experienced in the use of plastics, the following examples show how mistakes in material selection show up sooner or later. One such mistake in the past was with the crane boom which was made of a green general-purpose thermosetting molding material. To keep the part realistic, it was necessary to maintain a non-uniform wall section—bad engineering practice in thermosetting molded part design. The result was distortion and high breakage. In the future this part will be made from cellulosic compounds which have the capacity to tolerate non-uniform wall thicknesses.

The whistle—The whistle was originally made of die cast metal. When this material became difficult to obtain, Lionel was forced to change to a cellulose plastic. This was found unsatisfactory due to warpage, shrinkage and difficulty in assembly. When die cast metal became available again, the whistle was once

5—After the polystyrene Gondola cars are mounted on a continuous bent conveyor, they pass through a paint chamber and then on to the baking oven which is maintained at 160° F. 6—The model station house may soon have a roof of molded phenolic tile and base planks of the same material painted to achieve the desired terra cotta color

more produced from metal. However, at the present time, retooling is taking place in order that this piece may be injection molded from polystyrene. In this way the company hopes to obtain better economy through faster assembly, dimensional stability, a better strength-weight ratio and minimum air leakage.

Whistle impeller—The whistle impeller, which was originally made of a metal stamping and then assembled, was found to fit very loosely to the shaft unless soldered. This necessitated a change to a zinc die-cast piece. Production of this piece has since been changed so that the part is molded of general-purpose phenolic, chiefly because the use of this material reduced cost to one-sixth of what it was originally. Weight too was reduced by one-third.

Collector shoe—Another example of the failure of one plastic where another succeeded, and a subsequent return to the original plastic on the basis of better design, is the remote control collector shoe. This mechanism, which uncouples the cars when they are run over a special track, was originally made from a cellulose plastic. It was found that heat from short circuits distorted these pieces. Compression-molded phenolics were then used and proved satisfactory. To speed production, further reduce costs and improve strength qualities, the part itself has since been redesigned to eliminate heat transfer. This means that it is possible to use a 40-cavity injection mold and the original cellulosic compound.

It is of considerable significance that the company has found it to be easier in many cases to use either a transparent or colored molding material and paint it later to the desired shade. In the case of the Gondola car, for example, it was more economical to use transparent polystyrene which was then painted and baked to obtain the necessary dull finish. The same is true of the Pullman car molded of black phenolic.

Design, material, technique—are important

The Lionel Corporation feels that sufficient experience has been gained in actual production over many years with many plastics to prove that plastics must be used equally as carefully as metals. The use of the proper material in conjunction with correct design, good tooling, and skillful production, will assure an efficient finished part only if it is within the realm of the properties of the plastic itself to fulfill the duties required of it.

Credits—Phenolic, polystyrene and vinyl applications described in this article use Bakelite phenolic and polystyrene, and Vinylite.

DUPLEX PLATES AND PHOTOS, COURTESY FIRESTONE TIRE & RUBBER CO.

1—Yarn spun from vinylidene chloride monofilaments has now been woven into an ivory brocade with gold lamé dot embroidery. Belying its fragile appearance this fabric is stainproof. It can be wiped free of almost any stain with a damp cloth

Glamor and utility in plastic fabrics

BROCADE woven from vinylidene chloride monofilaments has made its bow in the high style field. Shot through with soft muted colors and embroidered with gold lamé this new Velon fabric brought gasps of wonder from an assembly of fashion editors when they first saw it made up into evening tunics, turbans and full length wraps. And it brought conviction too that synthetic fabrics will soon be invading every field where material is used, a conviction that is partly confirmed by the announcement that processes have been developed for the extruding of vinylidene chloride multifilaments from which the softer dress and drape textiles will be fashioned (Fig. 3). First stress, however, will be placed not on luxury fabrics such as brocades and sheers but upon material of a weight and texture suitable for upholstery and seat coverings.

Up until now

The development of Velon had really only started when the war broke out. Then, in an incredibly short space of time, the entire output of these vinylidene chloride monofilaments was assigned to the war department—for screening. But before it went into the service there was time for it to have been tested as upholstery material on public conveyances and as seat coverings in theaters and institutions.

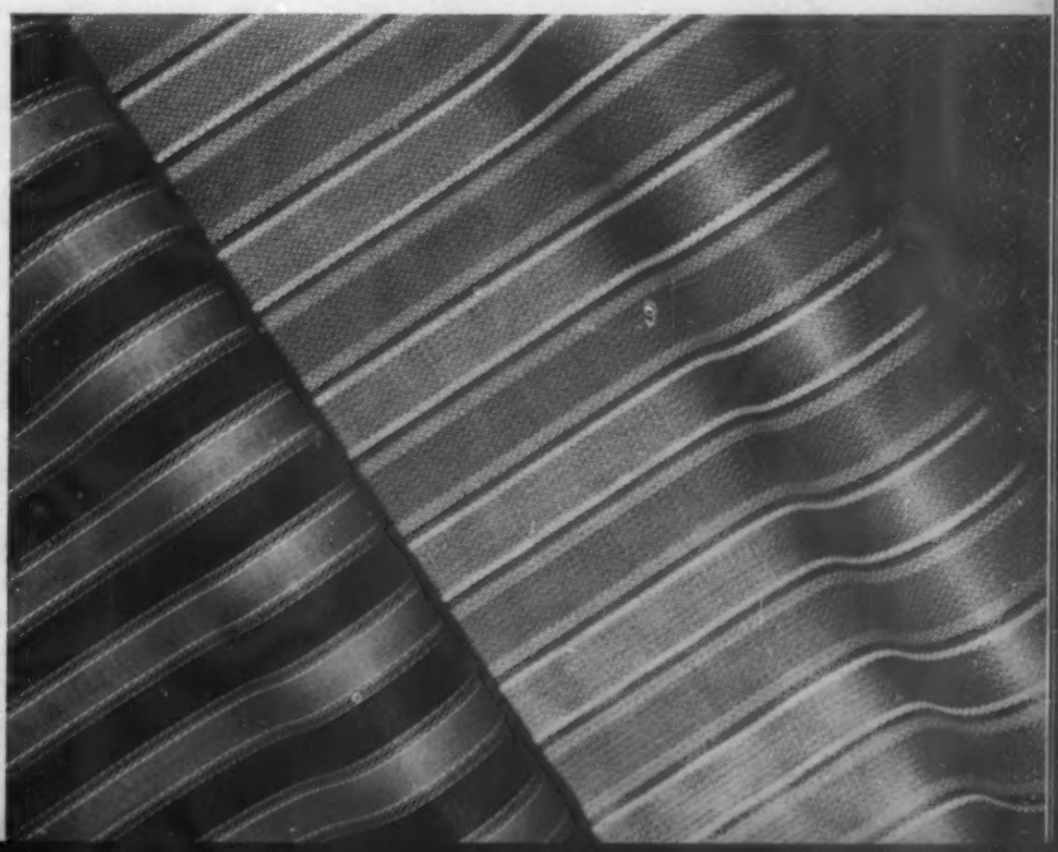
Constant hard wear, carelessness of guests and patrons, and continued exposure to dust and dirt are the conditions that are normal to institutional furniture. One of the major items of expense for hotels, theaters, hospitals and restaurants has been that of frequent redecorating made necessary by the failure of many conventional fabrics to stand the wear and tear. It was found that even after four years upholstery material woven from these plastic monofilaments retained its brightness and was not affected by cigarette butts, moths, acids and sunlight. So easily cleaned with soap and water, this material provides spotless and sanitary seating while saving institutional managers thousands of dollars in maintenance and replacements.

Properties of woven plastic fabrics

In addition to its resistance to stains, alkali and acids, moisture and salt air, this material is highly resistant to cracking or sun checking. When woven, the textile is remarkably tough and snag resistant, and practically fireproof. It will not sustain combustion but will char if exposed over a prolonged period to a direct flame. It has a tendency to soften under extreme temperatures but will withstand up to 170° F. without any noticeable alteration in its physical characteristics, up to 300° F. before melting.

Unlike most materials, especially those of animal or vegetable origin, vinylidene chloride monofilaments toughen when wet and their resistance to abrasion increases with age. Another property working to the textile's advantage is its non-absorbency.

Further, Velon can be manufactured with a controlled



2—Brocade is the newest cloth produced from extruded vinylidene chloride monofilaments — upholstery is perhaps the oldest. This medium-weight fabric has excellent draping qualities

elasticity. For example, it can be produced with a 10 percent elasticity with a full, but gradual, 100 percent recovery. This prevents sag and bag in the material, an important consideration whether the material is to be used for upholstery and drapery or for dresses.

But it isn't always the practical side that proves most interesting to a housewife when she selects a suiting, drapery or upholstering material. While the fact that such a material might wear well would be appealing, its aesthetic qualities would probably do more to weaken her sales resistance.

Color as a determining factor

As soon as production facilities permit, this material will be available in all the hues of the rainbow. It will be woven into soft pastels, into brilliant and vividly sharp basic colors, plaids, stripes and solid colors with a high degree of sun fastness.

The reason for the wide selection of colors and their sun fastness is that the pigments are basic in the vinylidene chloride monofilaments, or multifilaments themselves. The colors are ground into the plastic and thus become an integral part of the woven textile. This makes possible the production of designs that will continue sharp and bright for as long as a remnant of the material is in existence. Already designers are working on novel and unusual patterns that heretofore have been considered impossible because of the danger of delicate colors in conventional fabrics running and fading as the result of exposure to moisture or sunlight.

Weaving technique

When all vinylidene chloride monofilament production was allocated at the outbreak of war to the armed services for urgently needed screening, there was no time to build new processing equipment. It was necessary, therefore, to use the weaving machines at hand, making certain modifications and improvisations. The looms of Hafner Associates, Inc., designed for the weaving of fine upholstery, drapery and dress goods fabrics, was—and is—the equipment employed in the weaving of the 0.012-in. diameter Velon (the size monofilament presently in production) into military screening.

The synthetic yarn is received on large wooden barreled spools each of which can hold about 1 to $1^1/_2$ lb. of the spun monofilaments. Larger reinforced pins on

3—Sheer fabric woven from extruded multifilaments is in the experimental stage. Here an unfinished laboratory sample is compared with monofilament upholstery material. 4—Exceptionally heavy material is produced for use as seat covering in commercial transportation. This is the application where the fabric's stainproof qualities are put to the test. 5—Another vinyl material useful for luggage, shoes, handbags and upholstery is this leatherlike sheeting

the creel were provided to hold these packages. The warping mills or frames had to be reinforced to withstand the tension and pressure which this monofilament yarn exerts. In the beginning, wooden beams were used for this reinforcement until the more practical all-steel beams were available.

The quilling of this yarn is done by taking the yarn overend from the spool and passing it through a set of disk tensions with spring attachments. Regular quilling machines are employed for this purpose.

The tension and pressure exerted by the monofilaments because of their greater weight in comparison to ordinary yarns had another effect on the weaving operation. The mill found it necessary to reinforce the whole train of gears on the take-up motion. Special attention had to be paid so that the heavy rope let-off motion worked smoothly and the temples were properly set. Larger heddles, heavier drop wires and reinforced reeds were also necessary. Since these monofilaments are more flexible when heated, the application of higher temperature is essential to render the yarn more pliable for weaving, especially in the interlacing of the ends and picks. A finishing operation consisting of controlled heat and pressure is applied to the fabric.

With the end of the war, heavier types of looms will undoubtedly be available for the weaving of these monofilaments. And there will be opportunity for building warping equipment suitable especially for this type of yarn, and for developing new and improved methods of quilling the monofilaments.

6—Brocade woven of vinyl chloride monofilaments does not have to be kept under wraps. Because of the ease with which it can be cleaned, the fabric can be made up into turbans and shoes

However, wartime experience has shown that without purchasing new equipment, mills can produce cloth from vinylidene chloride monofilaments. Any textile mill can, with only minor and inexpensive changes, switch from cotton, woolens or rayons to this synthetic textile and back again.

Because of this, a seat manufacturing company would not be limited in its purchase of Velon seat covering to any particular mill. Mills which supplied him in the past with conventional seat coverings could supply him with this woven plastic upholstery.

Present and future applications

The application which will undoubtedly receive first attention now that Army demands for screening has eased up is that of upholstery for buses, trucks, airplanes, trains, street cars and other public transportation units. Then there is the private automobile.

Woven vinylidene chloride monofilaments as theatre seat coverings have already been mentioned, but their use in hospitals may prove even more important. Here the fabric's resistance to strong acids, disinfectants and cleaning agents, no matter how often applied, is the paramount factor.

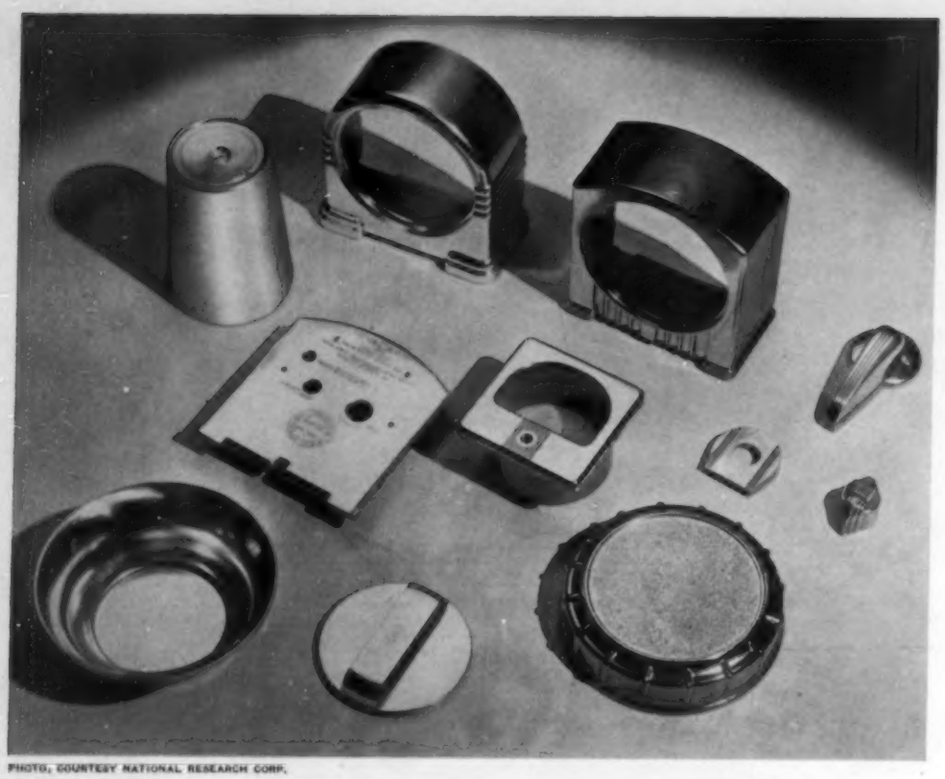
The material should also be available soon in tents, beach bags, belting, golf bags, swim suits, handbags and luggage, shoes, cables and twine, fishing equipment, millinery and curtains.

Although this fabric will definitely invade the fine dress and fabric field, as well as the hosiery and lingerie business, production costs now confine the limited amounts available to the ultra-fashion field. Increased production can be expected to lower the costs to such an extent that the material will, within a reasonable time, be available for more popular priced apparel.

There are two other members of this family of cloth.

Velofilm—This vinylidene chloride material, which can either be cast or calendered in from 1 to 50 mil thicknesses, is an excellent packaging material. In its heavier weights it is suited for raincoats and rain hats.

Veloflex—Resembling leather and imitation leather (Fig. 5), this material is waterproof and vermin proof.



PHOTO, COURTESY NATIONAL RESEARCH CORP.

Many novel and practical finishes can be obtained by coating plastic parts with metal, and vacuum evaporation provides a simple and quick method of plating plastics with gold, silver, aluminum, chromium, nickel, tin and even platinum. The finish of the metal coating depends upon the finish of the plastic to which it is applied

Metal coating by vacuum evaporation

by F. C. BENNER*

IT is frequently desirable to apply metal coatings to the surfaces of plastics for both ornamental and utilitarian uses. With the increasing production of plastic articles for civilian consumption, methods of metallizing plastics are commanding a great deal of serious attention. A new approach to this problem is the vacuum evaporation method which became established during the war years when it was used in the coating of glass optical surfaces with both low-reflecting materials such as magnesium fluoride and with metals such as aluminum, silver, gold, rhodium, chromium and other metals for use as front-surface reflectors. It appears safe to predict that novel finishes could be produced by applying this method to metallizing plastics.

Vacuum evaporation process

The vacuum evaporation process itself is relatively simple and when used with properly designed and engineered equipment offers no serious production problem. The metallizing is done in an enclosed tank or chamber which has been evacuated to an absolute pressure of 10^{-4} to 10^{-5} mm. of mercury. The articles to be coated are placed in the chamber in racks or jigs at a distance of several inches from a filament, or filaments, from which the metal is evaporated. The construction of this filament varies according to the particular metal being evaporated. It may be a coiled tungsten or molybdenum wire on which the metal to be evaporated is wound as wire. In other instances, boat-type containers of molybdenum or tungsten afford the means of evaporating the metal which may be in the form of pellets, granules or any readily available shape.

The filament is heated electrically until the temperature of the metal to be evaporated is raised to a point where its vapor pressure attains a value of approximately 0.01 mm. of mercury. At this point the metal evaporates at a rate sufficiently rapid to cover the articles with an opaque coating in a period of a few seconds.

Filament temperatures reach values of the order of several hundred degrees centigrade. Therefore, during the time of coating, heat is given off which is absorbed by the plastic articles. Normally, the coating time is short enough so that the plastic does not warm up to a temperature which will cause it to distort or will damage it. Some of the more highly plasticized plastics do, however, present problems because of a tendency to outgas badly. This results in an undesirable rise in pressure in the coating chamber.

The vacuum is produced in the coating chamber by a combination of mechanical pumps and a diffusion pump. The mechanical pump is used to "rough" the

* National Research Corp.

system down to a pressure of approximately 100 microns (1000 microns = 1 mm.) of mercury; at this point a diffusion pump, which has much greater pumping speed at these very low pressures, takes over the job of removing the remaining gas and evacuates the system down to the pressure of 0.05 to 0.1 micron required in the coating process. The total time required to pump a moderate-sized unit down to the requisite pressure need not exceed 5 or 10 minutes.

The over-all operation is conducted somewhat as follows: The plastic articles to be coated are loaded into the evaporating chamber in suitable jigs or frames through a door or port. The port is then closed and evacuation begun; when the proper degree of vacuum has been obtained, the filaments are heated by manipulating electrical controls mounted on a panel board, attached to or adjacent to the evaporating machine and the evaporation is accomplished. When the articles have been coated, the filaments are allowed to cool for a minute or two, the vacuum pumps are turned off or valved out of the system, and air is readmitted to the chamber. The loading port is then opened and the finished work removed. The entire cycle need not exceed a total time period of more than one-half hour, and on some units may take as little as 10 to 15 minutes.

Advantages of vacuum evaporation method

A great advantage of the vacuum evaporation method lies in the wide range of metals which can be deposited. Theoretically, any metal can be evaporated; practically, some limitations are imposed by the very high filament temperatures required to evaporate metals such as tungsten, molybdenum and similar metals. Fortunately, the more commonly encountered metals including aluminum, copper, gold, silver, chromium, cadmium, zinc, nickel and tin can all be evaporated without serious difficulty. Platinum, rhodium and palladium, however, require special techniques.

The finish of the metal coating depends entirely on the finish of the plastic to which it is applied. Coatings of aluminum and silver on ordinary sheet methyl methacrylate give very good mirror surfaces. Metals deposited on molded plastics likewise exhibit high gloss and brilliance and need no buffing.

Since the coating is formed by molecules condensing from the vaporized state, the film very closely follows the contours of the object. Stampings and indentations are evenly coated, the metal showing no tendency to fill up fine engravings. Very sharp masked areas can be obtained by use of suitable masks.

In general, no pretreatment of the plastic is required other than that necessary to insure the plastic being free from oil, grease, dust or other extraneous matter. In some cases, special pretreatment may improve the adhesion of the coating or impart other qualities.

The entire range of plastics to which this process can be successfully applied has not yet been thoroughly explored. Successful coatings have been applied to methacrylate, polystyrene, butyrate and some types of acetate plastics.

S.P.I. National Plastics Exposition

According to the latest figures, approximately 200 companies will participate in the first National Plastics Exposition to be held in the Grand Central Palace, New York City, on April 22 to 27. The show is being sponsored by the Society of the Plastics Industry.

The Plastics Exposition, which is the first ever held on a national basis, will bring together for the first time in one place and at one time the leading manufacturers of plastic raw materials and machinery, and the companies that process the compositions into end products. Attendance will be drawn not only from all parts of the United States but also from Canada, Latin America and Europe.

The show is designed to give manufacturers, whose knowledge of the properties and possibilities of the various plastics is necessarily limited, the salient facts about the industry so they can determine when and how they can use the various plastics in their own products.

Anticipating a large attendance of business executives from outside New York City and recognizing that many of these visitors will want to spent several days at the Exposition, the Society of the Plastics Industry is organizing a special housing bureau, which will be run by the New York Convention and Visitors Bureau, to assure adequate hotel accommodations for these out-of-town industry members.

Concurrently with the Exposition, the Society of the Plastics Industry will hold a convention at which leading authorities will tell about the latest advances in plastics technology and plastics applications.

In order to permit thorough study of the exhibits by representatives from industry, the general public will be admitted to the Exposition only on the last three days of its showing. Daily hours will be: Monday and Tuesday, April 22–23, from 11 a.m. to 10 p.m.; Wednesday, April 24, from 11 a.m. to 6 p.m.; Thursday and Friday, April 22–26, from 11 a.m. to 10 p.m.; Saturday, April 27, from 11 a.m. to 6 p.m.

Taking the curves with PLYWOOD

The sled-toboggan consists of the following plywood parts (shown at the left): runner, foreground; handle, directly in back of it; bumper, U-shaped part; 4 stanchions; the mortised back rest; the gee pole; and tray in the background

A NEW method of forming curved plywood parts by the partial bonding of the wood with two different types of resins at different stages in the production cycle is one of the many wartime developments which promises to have wide application for consumer goods. Worked out for the manufacture of binnacle stands, pack boards, pontoon bridge parts and calibration boxes, the process opens the way to economical assembly-line production of such civilian items as luggage, refrigerators and radio cabinets.

When early in the war the Army transported "men of the North" with sled-toboggans, the need was for a fast as well as an economical method of production. Lacking the equipment necessary for bag molding, the method used in making Army skis and toboggans, the Red Lion Cabinet Company decided to turn out the sled-toboggan convertibles by a new method which had been worked out in their own shops.

The sled toboggan was designed for transportation of weapons, supplies or wounded in areas where snow is prevalent. Since it is dependent primarily for its motive power on men, its weight was kept to the very minimum. Capable of handling a constant load of around 400 lb., it has been tested under 1000-lb. loads.

Basically, the components of the sled-toboggan are: runners (ski-type), tray (toboggan proper), handles, bumper, back rest, stanchions, gee pole (steering pole) and fastenings. Except for the gee pole, which is turned from a solid billet of hickory, all parts are made from Durez resin bonded birch or hickory plywood.

The runners are of 9-ply construction except at the turned end where extra plies are added to compensate for additional impact which may be encountered. Instead of the standard plywood construction in which alternate plies are cross-grain, these runners employ cross graining on two of the inner plies only.

In production, veneers for one double-width runner are assembled, coated with a heat-setting phenolic resin adhesive, and pressed in a standard plywood hot press at 300° F. for 20 minutes. However, about 20 in. of the bending end of the runner are not coated with the resin. After the assembly is removed from the hot press and allowed to cool, an intermediate-temperature Durez resin is applied to the previously uncoated portion of the runner and 4 extra plies of veneer inserted. Then the assembly is clamped between wood mold forms and put in a heating room for 3 hr. at 140° F.

When removed from the curing room the single assembly is saw-trimmed and cut in two. The runners are jig-drilled, given special coatings of creosote and pine oil on the bottoms, and moved along the assembly line for the addition of a sheet-steel reinforcing plate.

The tray proper is of 5-ply construction except for the reinforcing side and end pieces. The 5 plies, except for the front 20 in., are coated with resin and bonded together in a flat-platen hot press. When removed from the press the trays are placed in a specially designed curved platen mold and given additional heat and pressure. The 5-ply side reinforcements are then bonded to the tray.

The entire assembly is put through a standard spreader for a bottom coating of creosote, which is applied while the tray is still hot, so that it will dry faster and permit quicker handling. As soon as this coating is dry, the tray is passed to another assembly point where the unbonded section of the side reinforcements is bonded to the curved section with an intermediate-temperature phenolic resin and C-clamped in specially designed wood molds. At the same time end reinforcements (both ends) are cold-glued to the tray.

This assembly is allowed to stand overnight in a warm room. The reason for this overnight dry instead of a hot-room dry gives the operators time to process the runners, handles and bumpers.

Making toboggan accessories

The handles of the sled-toboggen are of 34-ply construction. One 6-ply section of hot-pressed plywood is assembled to the bottom surface of the handle, extending from the back rest to the point of contact with the tray. Veneers and reinforcement for the handle assembly are made approximately 6 in. wide to facilitate laying-up and processing. Later, three handles are cut from each assembly.

After the veneers and reinforcement have been coated with the intermediate-temperature resin and assembled into wood molds and C-clamped, they are placed in the curing room, just as are the runners.

Bumpers are laid up in veneer widths which permit four to be cut from each assembly. The veneers for the bumpers are coated in the same glue spreader as the handle veneers and assembled into wood forms which are placed in a hydraulic press and clamped. The clamped assembly is then given the speed-up cure in the curing room (3 hr. at 140° F.).

The back rest is of standard plywood construction—5-ply with alternate veneers cross-grain. This piece requires several cutting and drilling operations before a metal handle locating-plate can be attached. The stanchions (12 to each convertible) are cut from plywood which is standard except for the fact that only the center ply is cross-grain. Original blanks for the stanchions are of a size which permits approximately 60 to be cut from each blank. The only additional equipment required for the complete "convertible" is a white canvas paulin, load-lashing ropes and harness.

3—After the flat portions of the toboggan trays have been bonded under heat and pressure, the front 20 in. are put in a curved platen mold which accommodates 6 trays at a time. 4—The tray is then put through a standard glue spreader for a bottom coating of creosote. 5—When veneer widths of bumpers have been cut and glue-coated, they are clamped in a hydraulic press and the assembly is given a speed-up cure

ALL PHOTOS, COURTESY DUREZ PLASTICS & CHEMICALS, INC.

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PLASTICS IN REVIEW

2

1 The housing problem for plants and seedlings, though not acute, is nonetheless one of importance. To help solve the problem, Green Thumb, Inc. has produced a prefabricated cold frame with a wire-reinforced Vimlite covering which admits ultra-violet and infrared rays yet provides an excellent protection against hail and cold air. To give further protection, the insides of the upright sections of the frame are insulated with $^1/_2$ in. of Fiberglas applied by means of an adhesive. The cold frame is lightweight and can easily be assembled in about 10 minutes

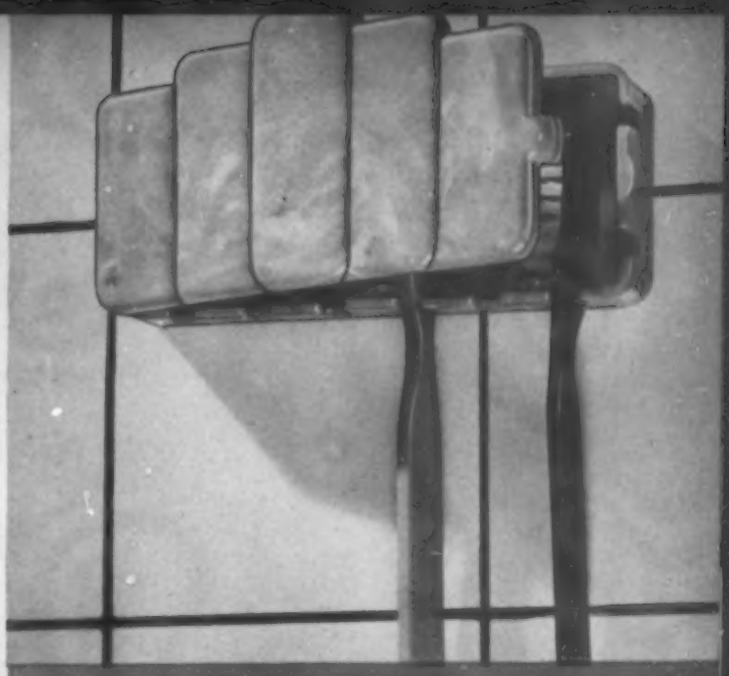
2 Washday troubles are greatly minimized by this new Saran clothesline which eliminates sagging, corroding, rotting and soiling of the line from the laundresses' worries. The braided vinylidine chloride strands, from which it is woven, are easily cleaned by wiping with soap and water. Utilizing an old Chinese custom, the end of the line may be neatly and securely attached by inserting it into a slightly spread part of the braid. Thus the line is tightened as it is pulled. The clothesline is designed, fabricated and distributed by Lee-Bert, Incorporated

3 Every home needs a toothbrush holder—but just what kind is most suitable has always been a vexing question. This holder, molded by the Hasty Products Co. offers a new and noteworthy solution. It is molded of Lumarith in two parts by the injection process, a complete box being produced in a 30-sec. cycle. The holder provides a sanitary, neat and convenient way of storing the family brushes. It is easily installed by means of screws or gluing the back to a tile surface. The Modgelin Co., jobbers, have found that mottled colors, formerly resorted to because of a dye shortage, have great customer appeal

4 Polystyrene in red, white or blue is the material used by C. F. Church Mfg. Co. in molding parts for this food cutter. The product is featured by Gadget Plastic Co., who specified Monsanto's material because of its resistance to moisture and its dimensional stability. For shaping squares of hamburger or dough it serves well and the housewife will find that the cutting edge is sharp and yet not dangerous

5 Babies are kept happy and safe with a colorful rattle that has been carefully rounded and smoothed to protect delicate hands and skin. Fairyland Plastic Products Co. fabricates the ring and the square rattlers of Lucite, the cross bars of polystyrene. After the methyl methacrylate strips that form the bodies of the rattles are curved to the desired shape, they are tumbled and polished, cold dipped dyed, assembled with the squares and polystyrene rods, the completed unit is polished again. Pink and blue ribbons are tied to the rattles before they are packed in boxes

6 Anything that will assist permanent wave operators and speed up the process is bound to be welcomed by beauticians as well as customers. And this tray was designed with just such a purpose in mind. It is molded and distributed by the Raymond Laboratories, Inc. who fitted the tray with several removable bowls for holding different waving solutions. The colors of the bowls make possible the quick identifying of the solutions. Bowls and tray, molded of Plaskon, are easily cleaned and will not absorb chemicals or become stained. The tray is molded in a one-cavity die in a 4½-min. cycle. The non-tipability and light weight of the tray are among its advantages



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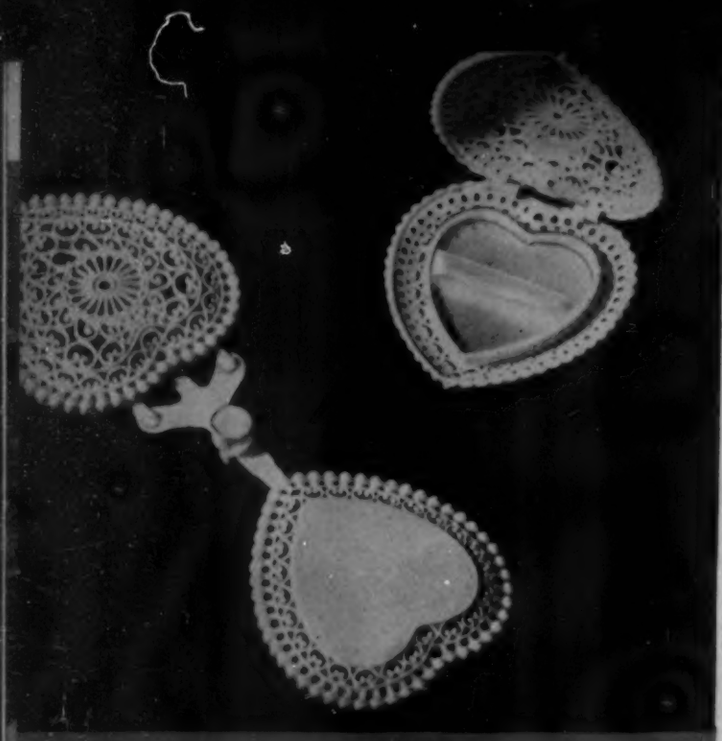

7 As an ambassador for cupid, this dainty box is destined to carry the ring down many a church aisle. It is molded from cellulose acetate by Foster Grant Co., Inc. The bottom and cover of the box are molded in a two-cavity die, the hinge-wire holes being drilled later. After assembly, the box is sent to the Dennison Manufacturing Co. who inserts the satin lining and distributes the ring box

8 Dealer's choice for a profitable game is this poker chip set manufactured and distributed by Scattergood of Hollywood. The company chose to make the holder of Lucite or Plexiglas cast sheets because of the ease with which they can be formed and because their transparency shows off the colored chips and makes an eye-appealing container. Although the company has several models, of various shapes, this is one of the most compact and has compartments for holding 2 decks of cards

9 The old and new combine in this J. L. Priess Dri-Perfume vial. The perfume is copied from an ancient Mohammedan formula while its case is made of a modern plastic material—Durez. The vial comes in lustrous black and is molded by the Northwestern Plastics Co. with a decorative vertical fluting. The powdered perfume is packed in a lining cardboard container and can be sifted through an opening at the top after the plastic cap has been removed. Dri-Perfume comes in 2 scents and a pinch of it is rubbed on the skin

10 Molded from urea or phenolic compounds, this electric plug, a product of the Waterbury Companies, Inc., is creating a demand for itself wherever it is displayed since it is not necessary to remove the insulation from the wires to make an immediate contact. The wires are simply inserted into two holes in the bottom and laid in the grooves as shown in the photograph. Then the top is screwed on. That's all. Brass teeth in the insert cut through the insulation to make a contact thus eliminating the tedious process of removing it by hand and screwing the wires down individually

7 8 9 10

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PLASTICS IN REVIEW

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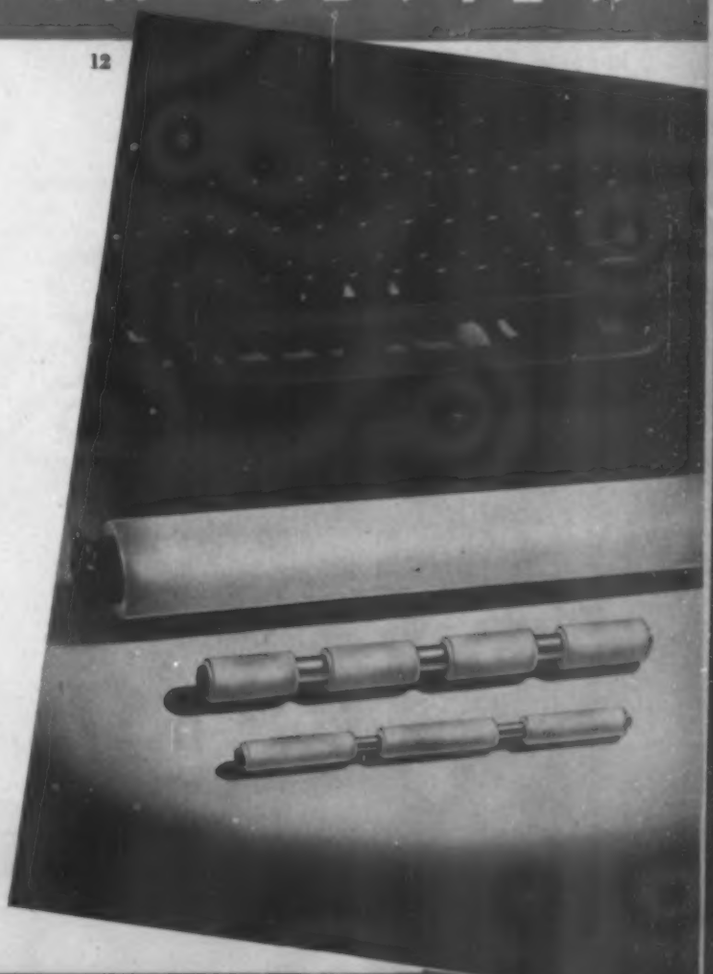


11 To provide children with a quality record player and still have it fit into the atmosphere of the nursery, this product has been created by Tone Products Corp. of America. The Mother Goose illustrations on the revolving turntable drum are printed in four colors on cellulose acetate by Hopp Press, Inc. This printed job is then laminated to a paper backing and the whole sheet is applied to the drum. The speaker grille is molded from Durez by the Accurate Molding Co.; the control knob is molded of urea. The turntable and the base are covered with cut rayon applied with an alkyd adhesive. Records up to 12 in. can be played on the phonograph which is a sturdy as well as an attractive toy

12 Many a typist's prayer is answered by this Lucite platen and feed roller set which can easily be affixed to any standard typewriter and makes possible the cutting of twice the normal number of carbon copies. The Lumirol Co., manufacturers and distributors, use a special machining and grinding operation to insure the accuracy of the methyl methacrylate parts to within one thousandth of an inch. The company claims that humidity and acids do not affect the platen as they do the rubber ones and that the cutting of stencils will not pit it. The parts are guaranteed to last the life of a typewriter

A MEASURE OF FREQUENCY

ONE of the fundamental measurements in radio engineering is that of frequency. Radio stations, assigned certain frequencies on which to operate, use highly complicated electronic equipment to hold these frequencies. For radio equipment factory use, however, and for routine laboratory work on experimental circuits, a relatively simple frequency measuring instrument, a wavemeter, is employed.

Molded housing for the newest wavemeter

The General Radio Company, one of the largest manufacturers of these meters, has just introduced a new model which is housed in a molded Bakelite case. This new plastic-encased wavemeter was specially designed for use in the new high-frequency bands which were employed during the war for radar and other services and which will, without doubt, have extensive peacetime uses. It is a Type 1140-A meter and has an accuracy of ± 2 percent of the indicated frequency—an accuracy which is independent of ordinary temperature and humidity effects—weight $3^1/_4$ lb.; is $7^1/_4$ in. long, $3^7/_8$ in. wide and $4^1/_2$ in. high.

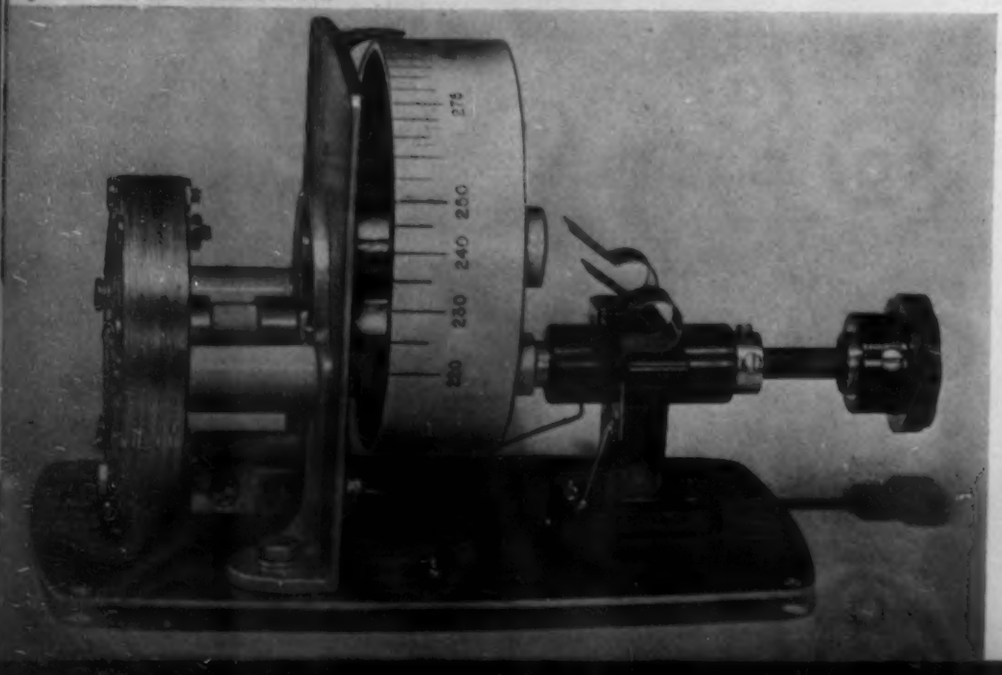
Case, knob, bearing and drum dial

Bakelite's No. 2498 material was selected for this housing because it had the flow qualities Plasti-Mold, Inc., molders of the part, wanted and because it left no flow lines. The case is a lot like a radio cabinet in construction, having quite thin walls and fairly wide sections. Control knob and shaft bearing are molded from Bakelite 120. This material is used by the General Radio Co. on most parts where high tensile and impact strength are required. The drum dial is white urea. It is molded in one piece; the calibrations and numbers are engraved on it in the plant. This is necessary because each instrument is individually standardized. The Bay State Molding Company molds this piece and the shaft bearing, while the Auburn Button Works, Inc., turns out the control knob.

The square-shaped end window is made of thin, clear and flexible Vinylite sheet, the piece being snapped into place during assembly and held by buttons that are molded into the inside of the case.

This newest addition to the wavemeter manufacturer's extensive standard line of testing and measuring instruments was created on demand from the industry. Its extensive use of various plastics is an indication of how these materials have now become standard with the radio industry.

PHOTOS, COURTESY GENERAL RADIO CO.



An interior view of the above wavemeter, after the phenolic case has been removed, shows the urea drum dial as well as the knob and bearing which are molded of phenolic compounds

PHOTOS AND DRAWINGS, COURTESY CELANESE CORP. OF AMERICA

1—To test the form-retentive properties of the flame-resistant series of cellulose acetate compounds, cartridge-type flare cases were injection molded from the new compositions XF-H6 and XF-H7 and from two other cellulose acetate formulations. Reading from left to right the four materials used are XF-H7, XF-H6, CAZ-10195-H7 and XM-H6

Testing flame-resistant cellulose acetate

by M. BENTIVOGLIO and B. E. CASH*

THE first article[1] to appear on the subject of flame-resistant cellulose acetate molding compositions created such a gratifying interest that the present article was compiled with a view to completing the description given earlier of this group of materials.

The flame resistance of these compositions, which is outstanding among cellulosic plastics, has resulted in their being grouped together to form a separate series of molding materials, known as Lumarith XF. The type symbol F, used in this series, is indicative of two qualities enjoyed by the compositions included in it, namely, flame resistance and form retention. The four Lumarith formulae comprising the series are: XF–H5 (formerly CAZ-13979-H5); XF–H6 (formerly CAZ-13978-H6); XF–H7 (formerly CAZ-13977-H7); XF–H8 (formerly CAZ-13976-H8).

Tests for form stability

The physical properties of these compositions were given in the earlier article; the evaluation of their form-retentive properties will be completed here. The tests which are listed below were carried out to determine the form stability of service pieces and test specimens molded from the flame-resistant materials and to compare this stability with that of other standard cellulose acetate compositions.

It should be pointed out that the majority of the tests described are severe. In fact, they are more severe than is practical for most applications and it would be technically unsound to require all moldings to meet the more drastic heat and/or humidity conditioning described. However, these test methods have been selected because the hard formulations involved require drastic test methods to bring out differences among them.

The comparative materials used in the tests described below to evaluate the form-retentive properties of the flame-resistant series are compositions XM–H3, XM–H5, XM–H6 and XM–H7, with very good moisture resistance and the special heat-resistant compositions Lumarith CAZ-11047-H5 and CAZ-10195-H7.

Five comparative tests

Test 1. *Sixty minutes immersion in water at 180° F. (Fig. 1)*—Each of the four compositions was injection molded into a cartridge-type flare case having an outside diameter of 1.5 in., a height of about 3.5 in. and a wall thickness of 0.053 inch. The die was bottom-gated. As can be seen in the accompanying photograph, the flame-resistant materials (XF–H6 and XF–H7) show an improved form retention over the other compositions XM–H6 and CAZ-10195-H7.

Test 2. *Warpage tests on bezels (Fig. 2)*—The following tests of increasing severity were completed on bezels:

a. 24 hr. at 120° F. over water, and 24 hr. at 120° F.
b. 24 hr. at 160° F. and 75 percent RH, and 24 hr. at 160° F.
c. 24 hr. at 175° F. and 75 percent RH, and 24 hr. at −40° F., and 24 hr. at 175° F., and 24 hr. at −40° F.
d. 24 hr. at 175° F. over water, and 24 hr. at 175° F.

All the specimens were conditioned before and after testing for 48 hr. at 77° F. and 50 percent RH.

The injection molded bezels used were rectangular frames about 1 in. wide and with an overall dimension of about 11 by 4.5 inches. They were molded in Lumarith XF–H7 and XM–H5 and in Lumarith XF–H8 and XM–H7. Each of these pairs contains for-

* Development and Research Laboratories, Plastics Div., Celanese Corporation of America.

[1] "Flame resistant cellulose acetate," MODERN PLASTICS 22, 102–104 (June 1945).

mulae of two series and of the same impact strength. The importance of impact strength as a measure of toughness of cellulosic plastics decided its selection as a basis for this comparison of the flame-resistant and of the other standard materials.

On the graph is plotted the amount of warpage out of plane, expressed in inches, for each of the four compositions. The results show that, with increasing severity in the tests, the increasing warpage observed in the Lumarith XM compositions is not found in their flame-resistant counterparts which show an exceptional resistance to deformation. It is to be noted, however, that the difference in form-retention qualities only becomes apparent in the more drastic tests.

Test 3. *Warpage test on flares* (*Fig. 3*)—Another heat and humidity test consisted of subjecting some flares, as described, to 24 hr. at 140° F. over water and then to 48 hr. at 175° F. over water. The less severe first part of this test resulted in no noticeable change in surface or shape of the flares, but the higher temperature exposure reveals the excellent form stability of XF–H7 compared with XM–H6 and CAZ-10195-H7.

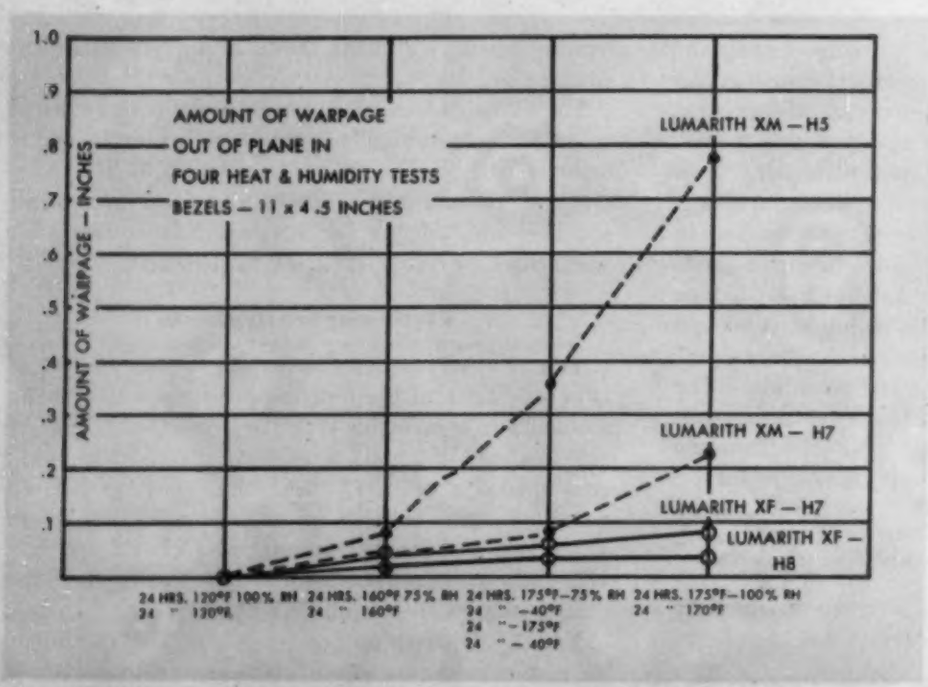
Test 4. *Dry heat test* (*Fig. 4*)—The superior dry heat resistance of the flame-resistant series is further shown by the fluorescent light sockets which were unimpaired after being subjected for 48 hr. to 230° F.

Test 5. *Deformation under load* (*Fig. 5*)—Further evidence of the excellent form retention of the flame-resistant series is to be found in the deformation under load (cold flow) test, which yields for these compositions some of the lowest values recorded for cellulose acetate.

Two compositions of each of the XF and XM series and two special formulae, CAZ-11047-H5 and CAZ-10195-H7, were tested for deformation under load at 120° F., which is the temperature required by the A.S.T.M. method D621–44T.[3] The test specimens were solid $^1/_2$-in. cubes.

The results of this test are shown by solid lines in the graph (Fig. 5) where deformation under load is plotted against the impact strength of the compositions tested. When compared on the basis of equal impact strength, the superior resistance to deformation under load of the

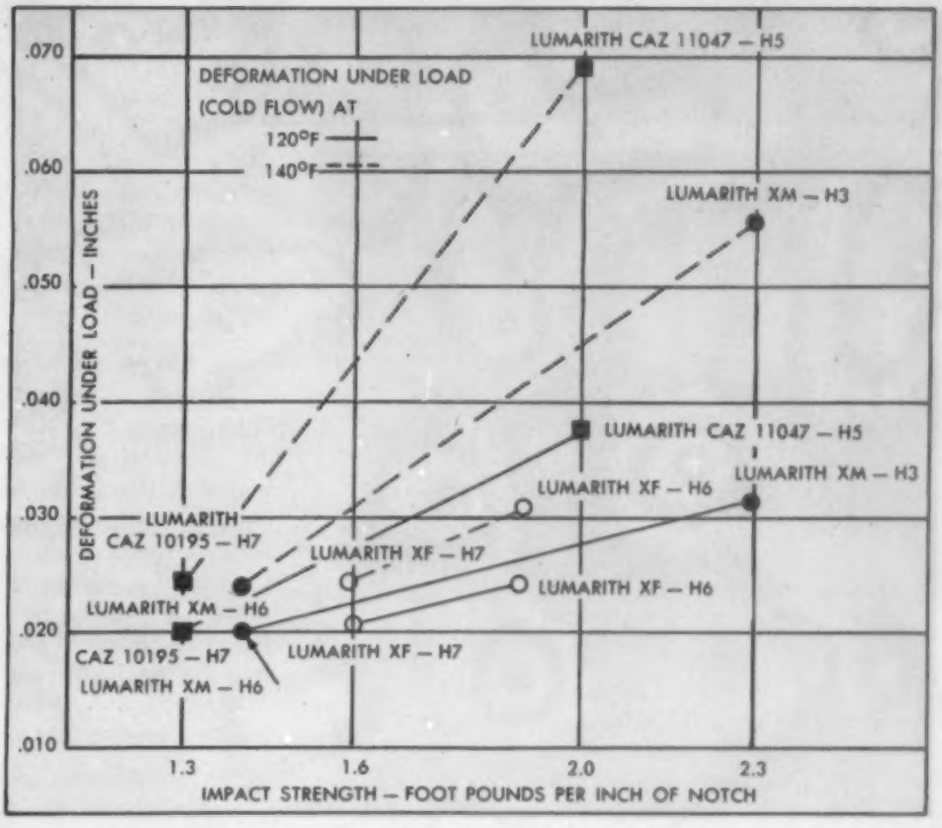
[3] "Molding with Lumarith," by Celanese Corp. of America, p. 61, contains a description of this test as modified by the Celanese Plastics Division.



2—Four warpage tests were made on bezels molded of cellulose acetate XF-H7, XM-H5, XF-H8 and XM-H7. Results of tests are indicated on the chart at left

3—As a further heat and humidity test, the flares used in Test 1 and shown in Fig. 1 were maintained at a temperature of −140° F. for 24 hr., then −175° F. for 48 hours. Reading from left to right the materials used in these flares are XF-H7, CAZ-10195-H7 and XM-H6

4—Fluorescent light sockets molded of this flame-resistant series were also tested and shown to have an excellent resistance to dry heat



5—Four cellulose acetate compounds were tested for deformation under load. One formula was of the XF series, another of the XM series and two were special compositions. The test results are shown at the right

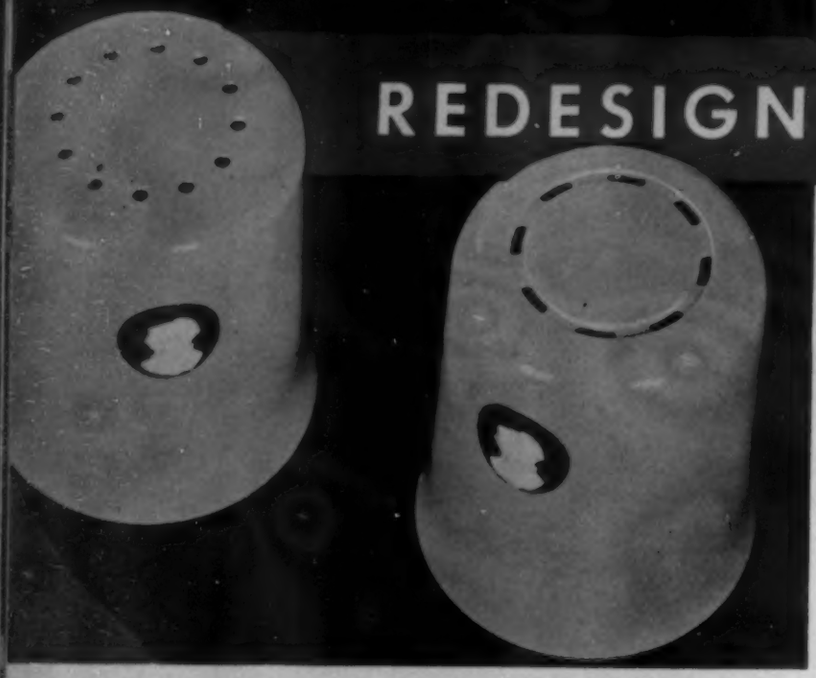
flame-resistant compositions is seen. Tests were also made at a temperature of 140° F. and the results, plotted in dotted lines, again reveal the greater resistance to cold flow of the Lumarith XF series. This test confirms the previous observations.

Molding and fabricating qualities

The molding qualities of this series call for the following comments. It has already been pointed out in the previous article that the injection molding temperatures have been found to correspond to those required for materials in other series of from two to three plastic flow steps softer. Moreover, the molding range is somewhat narrower than for other standard materials, and it is recommended that the molding temperatures be kept as low as possible in order to avoid possible streaking and darkening of the color. Field experience has shown that the overall molding cycle is shortened with the use of the flame-resistant materials.

The compositions of the Lumarith XF series lend themselves especially to the fabricating of parts needed in the electrical industry. For example, their form retention and rigidity on exposure to high temperatures and their flame resistance make them a favored plastic for fluorescent light sockets. They should be eminently suitable for coil spools, where a minimum cold flow and maximum resistance to heat and humidity are essential factors. Moreover, in common with other cellulose acetate compositions, they provide high dielectric strength, high arc resistance and protection from corrosion to copper windings. To date, other applications in the injection molding field where these compositions have found favor include molded terminal blocks, small housings, grommets and containers.

REDESIGNED FOR USE



1—The slots on the top of the redesigned dispenser supplant the round holes on the earlier model. 2—The base of the new unit (right) is notched to give a grip to wet hands, a contrast to the construction of the old container (left). The cardboard container (center) has a rip cord which removes the entire top for using the package with the dispenser

1

ALL PHOTOS AND DRAWINGS, COURTESY CAMEO CORP.

2

TO change or not to change? The problem of whether to alter the design of a product with a highly successful record of consumer acceptance faces many a business executive these days as his company swings back into the production of peacetime goods. It is a question which confronts makers of hundreds of consumer items, ranging from fountain pens to washing machines. Even on a relatively low cost molded plastic item, considerable courage is required to relegate the old dies to limbo and come forth with something different. After all, who can say for sure just how the new design will go?

One firm which has taken this dilemma firmly by the horns is the Cameo Corporation, whose colorful molded plastic dispensers for Cameo Cleanser have become a familiar accessory in kitchens and bathrooms all over the U. S. since the introduction of the product and its special holder in 1937. With its distinctive cameo trademark, the durable convenient dispenser has been a primary factor in building the popularity enjoyed by this product. However, notwithstanding the success of the dispenser, Cameo Corporation and Barnes & Reinecke, who evolved the original design, began work on modifications in March 1944 and have developed several interesting changes which, while they do not affect the essential features of the dispenser, improve it in important respects.

Three parts—how they are made

The body of the dispenser, compression molded of Plaskon in an 8-cavity mold, is now being produced in red, white, ivory, green, blue, peach and yellow. Formerly, it was also supplied in black and lavender, but these colors are being discontinued. The cameo decoration, injection molded of cellulose acetate, is applied to the wall of the dispenser by means of a gluing operation. The base section, molded of black general-purpose phenolic, is threaded so that it can be unscrewed from the top for the insertion of the primary container. The paperboard package itself has a metal top which can be completely removed.

Testing market acceptance

In an effort to determine just what design changes would be acceptable to housewives, Cameo and the industrial design organization went directly to the ultimate users for the answers. A sample dispenser was made on which the black base section came up considerably higher than on the standard model. Members of a prominent Chicago women's club were given an opportunity to examine the model and fill out a questionnaire reflecting their reactions to it and to the old standby. Final tabulation showed the standard model out ahead by a comfortable margin, demonstrating once again that the public is inclined to be conservative regarding pronounced changes in products with which it is familiar.

One point which worked to the disadvantage of the proposed new design was the fact that its slightly larger diameter was less easily grasped by an average feminine hand than was the regular model, which has a waist measure of $3^1/_2$ inches. By way of a compromise, it

was decided to deepen the base slightly and to incorporate ridges to facilitate grasping and turning with slippery hands.

With the basic soundness of the original dispenser design strongly confirmed, the modifications ultimately decided upon were mainly of a utilitarian nature. Whereas the standard unit carried circular holes in the top for sprinkling the cleansing powder, the redesigned unit calls for a circular groove in the domed top surface, around which 8 oblong slots are equally spaced at equal intervals. The revised top dispenses slightly more powder with each shake of the holder than did the earlier design.

Problems attending the redesign

A rather stubborn mold problem was encountered in getting the outer edge of the countersunk ring in the top of the dispenser body rounded off so that it would be pleasing to the touch. In addition, a sharp edge tended to collect dirt in use and formed an unsightly ring around the top of the dispenser. This sunken section was successfully rounded off by enlarging the insert plug in the bottom of the mold and applying a radius to it that blends smoothly into the outer contour of the gently rounded top.

The use of an insert plug in this molding is also desirable from the standpoint of economy. The section of the die which forms the pouring slots is subjected to intense pressure during the molding operation and must be replaced at intervals when it becomes worn. Details of the revised mold design are shown in Fig. 4.

On the former dispenser, the cameo medallion which serves as the identifying feature of the unit was injection molded in one piece and glued to the body of the dispenser in the plant of the cleanser manufacturer. Before the gluing operation, it was necessary to use a template and lacquer the background of the cameo black with an airbrush—a highly skilled operation because of the irregular outline. Even though the finished effect was satisfactory, it was found that after a period of use the black lacquer began to wear off, somewhat spoiling the clean-cut appearance of the emblem.

In the redesigned dispenser, this difficulty is eliminated at the source by injection molding the cellulose acetate cameo and background in two separate pieces—one in white or ivory, the other in black. As shown in Fig. 3, the background section is slotted to receive a projection molded on the back of the cameo. This construction insures a close fit. The two pieces are glued together and then glued to the dispenser body.

Even with the modernized dispenser, which at present appears to incorporate the last word in both function and appearance, neither the cleanser manufacturer nor the designers are content to freeze the design. Instead, the search for further ways to improve this popular product goes on unceasingly.

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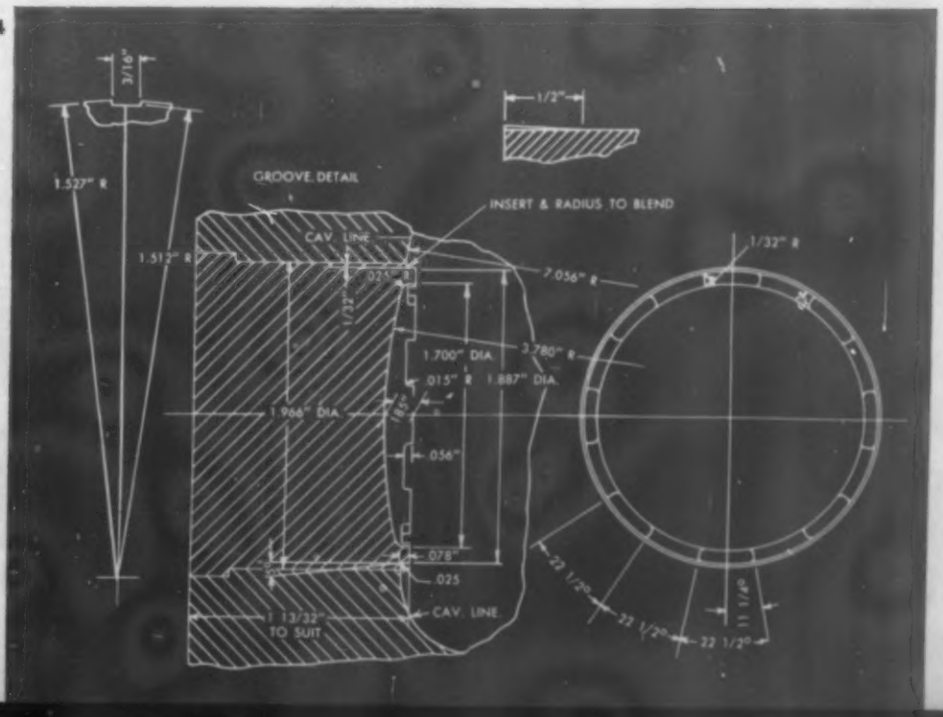


3—Cellulose acetate cameo emblem, formerly in one piece, is injection molded in two parts. The black acetate background eliminates lacquering. Pieces are glued together, then to the dispenser body. 4—Detail drawing of mold section for top of new dispenser. Problem of rounding off outer edge of countersunk ring was solved by enlarging insert plug in bottom of mold and applying radius that blends with outer contour

Resin bonded glass fiber fly-rod

by ARTHUR M. HOWALD*

SINCE the 6-section split bamboo fly-rod was developed some hundred years ago, it has not been successfully challenged for delicacy in casting, strength or pleasure in its use. Now, the invasion of even this field by plastics seems indicated.

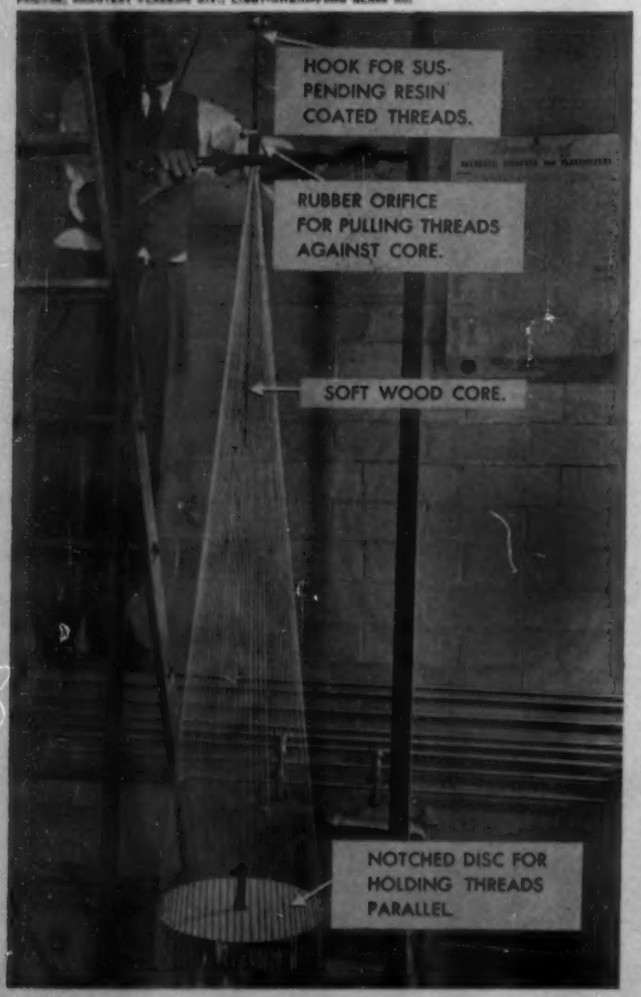
It was wartime experience with the new heat-hardenable Plaskon 911-11 resin reinforced with high-strength Fiberglas fibers in the preparation of structural aircraft parts, that led to a realization of the similarity of this plastic combination and that used by nature in bamboo. The bamboo or cane used for the 6 strips that make up the average fly-rod consists essentially of closely packed parallel cellulose fibers supported by lignin binders and siliceous deposits. Concentration of fiber density near the outside of the rod, where stress on bending is greatest, accounts for the high weight-to-strength ratio and stiffness of the split bamboo construction. It was apparent that if the glass fibers are stronger than the fibers of bamboo and if the synthetic resin used to bind and reinforce them is superior to the natural binders, then construction of an improved fly-rod was a possibility.

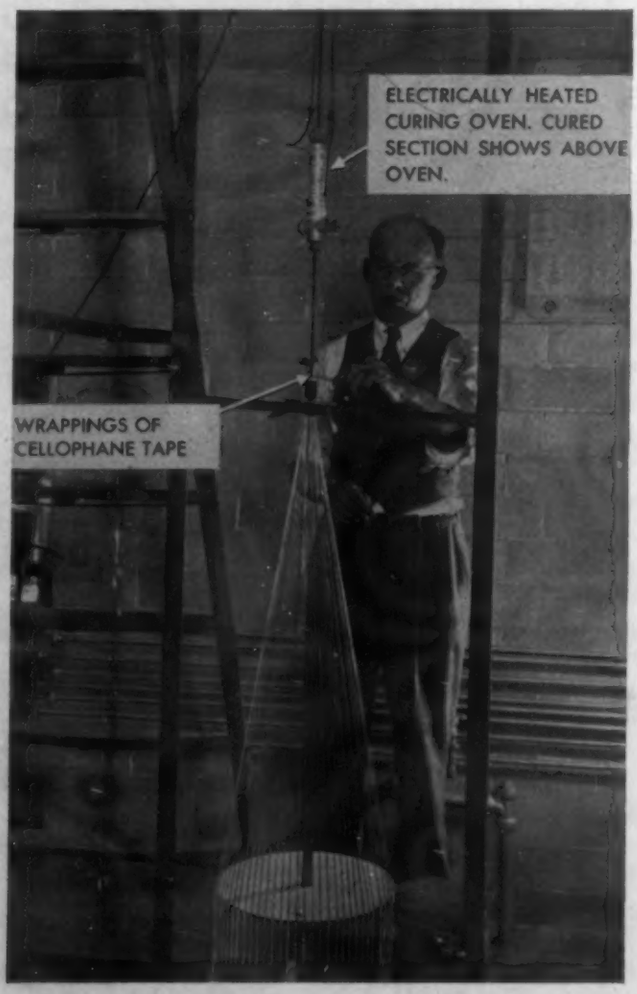
After preliminary experiments on the strength of glass fiber resin combinations in small diameters, a technique for hand building the plastic fly-rod was developed. Over a lightweight non-structural tapered wood core, analogous to the pith of the bamboo, was

*Research Director, Plaskon Div., Libbey-Owens-Ford Glass Co.

A fly-rod surfaced with resin-bonded glass fibers is stronger, lighter in weight yet much more pleasurable to use than a bamboo rod. Below are shown the first two steps in the making of the rod

PHOTOS, COURTESY PLASKON DIV., LIBBY-OWENS-FORD GLASS CO.


HOOK FOR SUSPENDING RESIN COATED THREADS.
RUBBER ORIFICE FOR PULLING THREADS AGAINST CORE.
SOFT WOOD CORE.
NOTCHED DISC FOR HOLDING THREADS PARALLEL



S.P.I. Standard for tolerances in molding

Carrying the title "Standard for Tolerances on Molded Plastics Parts," the third chapter of the technical handbook being developed by the Engineering and Technical Committee of the Society of the Plastics Industry has just been made public. This chapter represents a cross-section of the molding tolerances of the most commonly used molded thermoplastic and thermo-setting materials, excluding laminates, which leading molders have found they can hold. This representative information is the result of circulating questionnaires to leading molders. Information about other materials and about dimensional stability of plastics will be published later when it has been collected and compiled.

The chapter contains numerous tables and aims to cover most of the tolerance conditions which molders are called upon to face, such as longitudinal and diametric. The Society recognizes that the data presented may not conform with all possible conditions which may arise, but it believes the chapter contents "provide a basis on which molding tolerance standards may be established."

The Committee defines molding dimensional tolerances as "the allowable variation from the mean or basic dimension," which properly falls into three categories: fine, standard and coarse.

Fine tolerance—The narrowest possible limits commensurate with closely supervised and controlled production.

Standard tolerance—The usual commercial tolerance that can be held under average conditions.

Coarse tolerance—Broad variation where dimensions are not considered an important factor.

The Engineering and Technical Committee of the S.P.I. further emphasizes that tolerances have a direct relation to the cost of a molded product. That is, the closer the tolerance that is demanded, the higher the cost both in tooling and parts.

The full text of this third chapter, "Standard for tolerance on molded plastic parts," of the S.P.I. Technical Handbook may be obtained by writing the Society of the Plastics Industry, 295 Madison Ave., New York 17, N. Y.

The text of both the first and second chapters of this book has appeared in full in pages of MODERN PLASTICS. Chapter 1, "Classification of molding materials," was published in the October issue, page 134, Chapter 2, "Design standards for inserts," appeared in the January 1946 issue, pages 142 through 154, 192, 194.

applied a hard, strong surface of parallel glass fibers bonded with synthetic resin.

The method used in building this rod is clearly detailed in our illustrations. From a hook in the ceiling were suspended a large number of glass fiber yarns which had previously been impregnated with the requisite amount of synthetic resin (about 30 percent). The yarns, with lead weights on the lower ends, were arranged in the form of a long cone by being spread over a notched disk positioned near the floor. A tapered core of soft wood, lightly coated with resin, was placed inside the glass yarn cone with its heavy end up. A rubber stopper with one small central hole was then pulled down over the glass cone, pressing the glass yarns, as it moves downward, firmly against the wooden core in a completely parallel arrangement.

Next, that part of the rod above the rubber stopper was tightly wrapped with narrow cellophane tape, which served to hold the fibers firmly against the core. An electrically heated tubular oven, made of $^1/_2$-in. pipe, was brought down to cover the wrapped section of the rod. A temperature of about 225° F. served to harden the resin in a few minutes. After this curing period, the plastic surface of the fly rod was hard and strong.

It is obvious that if all the glass fibers were continued to the tip, the rod would become tip-heavy and useless. To prevent this, yarns were cut and removed as the rubber orifice was brought down the structure. This acted to taper the plastic surface in proportion to the wooden core.

After the whole length of the rod was finished, the spiral wrapping of Cellophane was removed, and guides, reel seat, grip and tip installed in the usual manner. These rods may be lacquered or varnished although the synthetic resin gives the fly-rod a highly lacquered appearance.

The new rod construction may be made to duplicate the best bamboo in stiffness and action with a saving in weight and an increase in breaking strength.

The 8-ft. two-piece rod of the new construction, weighing $3^1/_2$ oz. has been used a great many times during the past season with much pleasure and profit by the author.

The use of plastic is not a cure-all, as light delicate rods of the new type must be cared for much as are those constructed of the best bamboo. Enthusiasts will welcome the possibility of obtaining new and untried variations in taper possible with the new resin-bonding process.

Molded bases for round fluorescent bulbs

THE new year—Christmas really—saw the introduction to the public of a new type of fluorescent light, one with a round bulb. While these lamps were offered in but a single size and shape, though four different pastel shades of coral, blue, green and maize were available, it seems almost certain that by the time another Christmas season rolls around there will be Santa Claus shaped fluorescent lamps and others in the forms of candles and like articles. In fact, the significance of these new bulbs lies in their evidence that fluorescent lighting is no longer limited to tubular lamps but is as adaptable as incandescent lighting to a wide vareity of shapes and sizes and will, eventually, be just as versatile.

Developed by Sylvania Electric Products, Inc., these lamps need no special auxiliary equipment in order to operate. They are marked for AC operation.

1—Round fluorescent Christmas tree bulbs were an innovation last season. 2—The adapters are molded of phenolic

PHOTOS, COURTESY SYLVANIA ELECTRIC PRODUCTS, INC.

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Molded phenolic adapters

Contributing to the successful operation of these fluorescent lamps are phenolic adapters which are designed to be cemented and baked to the steam of each bulb. Molded of mineral filled phenolic, these bases are flared at the top so that they will fit the necks of the lamps which cannot practically be made small enough in diameter to fit into candelabra bases without impairing their strength. This flare also leaves room for the resistance which is connected electrically to the cathodes in each light.

Twenty full-positive individual molds are used by the Woodruff Co. to produce 20,000 of these adapters per shift. Running on a 0.45-min. cycle, these small parts are turned out on a special type of patented rotary indexing molding machine. The single molds are assembled at each station of the machine, and they mold, open and eject the parts automatically as the unit rotates.

The molding pressure is supplied to each station of the machine by a separate hydraulic ram. This arrangement has the advantage of protecting the mold parts from damage even should a double shot occur. If the pressure were applied mechanically, the mold would, no doubt, be ruined or very badly damaged by a double shot.

The material loading and the ejection of the parts is controlled automatically. However, an operator is stationed at each machine as a precautionary measure. A system of high-pressure pumps, feeding into an accumulator, supplies the necessary pressure for several of these rotary indexing molding machines.

The phenolic adapters are given an after-bake for 3 hr. in an oven maintained at a temperature of 360° F. This baking obviates shrinkage of the plastic when, after the glass bulb and the adapter are cemented together, the assembled fluorescent light is subjected to high temperature from an open jet.

Assembly of the bulbs

The blown glass bulb, coated on the inside with phosphor, and the molded phenolic adapter come together at the assembly line. First it is necessary to seal the bulbs, with the electrodes inside, to the metal stems or mounts (Fig. 3). From this machine the tree lights go to a machine (Fig. 4) which exhausts them of air, gives the electrodes a special heat treatment and pumps them full of rare gases. The bulbs are then tipped, an opera-

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3—Bulbs coated elsewhere with fluorescent powders are brought to the assembly line where they are sealed to the mounts or stems. 4—In the next operation, a machine exhausts air from the bulbs, gives the electrodes a special heat treatment and pumps rare gases into the bulbs. The bulb is then hermetically sealed. 5—With a resistor welded to one of the lead wires in each lamp, the bulbs are fed to the basing machine (center) where the lead wires are clipped and the bases baked to dry the cement that holds the bulbs and bases together. 6—Finally, just prior to final testing, the lead wire in each lamp is soldered

tion which hermetically seals them. With this operation, the lamps are completed except for bases and resistors. And this latter part is added to the lead wires as the bulbs move to the basing machine.

All the steps in the manufacture of these lamps can be seen in Fig. 5. Particular attention is called to the machine in the center of the illustration which clips and solders the lead wires and bakes on the bases. It remains to give each light a thorough inspection as to appearance and performance.

Each fluorescent bulb is subjected to a 15-min. test in a seasoning rack. And during this time it is inspected for uniformity of color, for spots and other flaws. As the lights come through these tests they are marked for color and with the electric company's identification. Finally they are packed 100 to a box and sent to the string manufacturers. The marking of color is necessary since all the bulbs appear to be white until they are lighted.

Why they'll be on future trees

Besides providing an unusual decorative effect, these new fluorescent lamps have several advantages over the usual incandescent bulbs. Each lamp burns about 5 watts of current and has an approximate life of up to 1000 hours. Because they burn cool, the lamps do not hasten the drying up of Christmas trees. Further, they can be used either indoors or out.

COLOR in shock-resistant materials

ALL PHOTOS, COURTESY ECLIPSE MOULDED PRODUCTS CO.

Now that shock resistant melamine molding compounds are available in white, ivory and many colors, plastics should be capturing more of the household markets that require maximum sturdiness—like washing machine agitators

WASHING machine agitators, vacuum cleaner housings, shock resistant food trays, baby sterilizers and many other commonly used items may now be produced in a range of standard colors from a new shock resistant melamine-formaldehyde molding compound[1] which is tough enough for heavy duty applications yet retains the color which is so important to the public acceptance of plastics. Known as Melmac 3020, it is the first thermosetting plastic to combine these properties.

Melamine resin has the ability to combine readily with many types of filler materials, and a choppedc otton cloth-resin combination provides strength along with other excellent properties characteristic of these resins. Essentially a wartime development, the product was first introduced in black and mottled white to fill military needs.

It has a very high flexural strength, arc and flame resistance that accounted for the first uses of this material. Heavy duty circuit breakers and other electrical parts were molded and gave excellent performance in service. The black material has also been accepted for such industrially important electrical applications as the insulating sections of electric meters and the insulating parts on heavy duty mining machinery control mechanisms.[2] Chemical resistance and low water absorption were responsible for its selection by a leading pump manufacturer for use as stators in units pumping solvents, other chemicals and foods.

[1] Developed by American Cyanamid Co.

From mining equipment to food containers

Shock resistance, lack of taste and odor, resistance to food staining and a clean, attractive surface were the properties required for another volume application of Melmac 3020. A line of sturdy food containers was designed by Devide Foods, Inc.,[3] and the mottled white molding material was chosen. These containers have been very widely used by hospitals, railroad club cars, restaurants and many institutions and schools.

The Army Medical Corps required a shock resistant plastic for a newly designed compartment hospital

[2] "Melamine in the mines," MODERN PLASTICS 23, 108, 109 (Nov. 1945).
[3] "Mass serving of foods," MODERN PLASTICS 22, 113–115, 198 (May 1945).

mess tray. For satisfactory performance under service conditions, this molded tray required an impact strength even greater than was available with a urea compound. Consequently, the melamine resin was modified with a small addition of phenol—raising the impact strength 50 percent as measured by the Izod test. Hundreds of thousands of these compartmented mess trays have gone into service in Army hospitals.

Five colors added

At the end of the war, when it was possible to offer for domestic consumption a material with these outstanding characteristics, considerable thought was given to the possibility of providing it in colors. Much experimentation with different types of chopped cotton cloth fabrics, with bleaches and dyes, resulted in methods whereby standardized uniform colors could be achieved. Now, white, blue, green, red and ivory molding compounds are immediately available to supplement the original black and mottled white materials. These are standard, attractively mottled colors, stable and colorfast in molded parts.

Other shock resistant plastics have been available in the past, but all had limitations. Some were produced in color, but possessed low heat resistance and were unstable when exposed to boiling water. Others stood up well when exposed to heat but, lacking color, did not make for good appearance. Now that color has been added to a thermosetting plastic, an entirely new field is open.

In step with the new civilian products

Recently, agitators for washing machines were molded from the several colors available with this new material. The white, blue, red and green agitators should please housewives accustomed to the black and brown parts that afford a jarring note in a machine that is in all other respects modern in design. The ease with which these agitators can be cleaned and the fact that the plastic material will never corrode, as metal parts have a tendency to do, should improve the quality of the job done in cleaning clothes. In addition, an agitator made from Melmac 3020 is unaffected by the soaps and other compounds used in washing and will withstand the necessary temperatures.

White and colored food trays, both plain and compartmented have been molded of this melamine compound and have been found, under test, to perform in a splendid manner. Baby dishes and bottle warmers, various parts for refrigerators and stoves, syrup dispensers for use in drugstores, germicide containers and many other parts are either under experimentation or in production.

Inasmuch as this plastic satisfies rigid strength, electrical and food resistant specifications at the same time that it provides the color so essential to today's living, it is likely that the consumer will look for it in many of his commonly used products.

It seems, at times, as though this product was designed for specific applications. For instance, there is today great interest in plastics for refrigerators and deep freeze unit drip trays. A list of required characteristics prepared by designers of new machines in this field, when compared to the properties of Melmac 3020, shows that it is satisfactory on every count.

Among its molding characteristics are; lack of gasiness, speed of cure comparable with alpha-cellulose filled ureas and melamines, satisfactory ejection of parts, no tendency towards resin segregation in complicated moldings. Since the product has a relatively high bulk factor, molds should be designed to allow for sufficient loading space.

Besides adding color to washing machine agitators, this melamine compound produces units that soaps do not affect

Trays are another outlet for the shock resistant material which is odorless, tasteless and has a smooth surface

Beauty's an open book to the lovely lady who delves between the covers of the flower ornamented compact which Lentheric presents in Plexiglas.

The book-shaped design of the plastic case with the peculiar undercut needed to achieve the concave curve on the front edge of the case presented a serious molding problem, overcome only in a mold with a cam action.

Close attention was paid to details in arriving at the design. For instance, a slight convex curve in the front edge of the smaller of the two compartments assures good fit for the lipstick, while at the back of the compartment a very low wall serves to keep the lipstick in place and yet allows room for the user to insert a finger for removing it. The nicely rounded back of the compact carries out the book design, allowing room enough between that and the back wall of the powder and lipstick compartments for the lid to swing shut freely.

The compact is injection molded in two-cavity molds. Holes for the catch and hinges are jig drilled. After a decorative strip of cardboard-backed paper with a mirror cemented to its back is slipped into place in the cover of the compact, the whole insert is sealed around the edges to prevent powder from leaking through.

In selecting acrylic for the compact case, the manufacturer took into consideration its light weight, crystal-like appearance and dimensional stability.

PLASTICS

"The old oaken bucket" has nothing on the kitchen tap that is equipped with a polystyrene water filter to assure clear, refreshing water. Introduced by Empire Distributors, the Klearking filter has two plastic parts—both injection molded of Styron by Chicago Molded Products Corp. who also designed and fabricated the molds. The head is permanently attached to the faucet by a positive universal connector. The lower part or base can be unscrewed and removed, leaving the head to act as a sprayer which can be used for washing vegetables or for rinsing dishes or for some task of a similar nature.

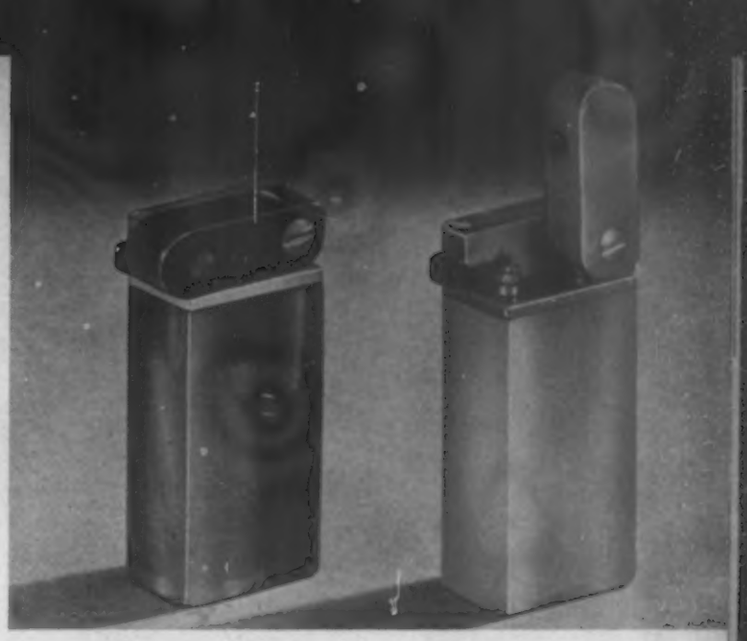
The reason for the use of plastics in this application is really the raison d'etre of the kitchen filter itself. Its predecessor, a larger unit involving a white metal casting, had a record of sustained performance over a period of years in water coolers for business and industrial concerns. This filter, which employs the same filter disk, was, because of the metal used, too expensive for the average home. Therefore in designing a new filter around the patented disk, the manufacturer turned to plastics for a material that would be economical and have low moisture absorption, immunity to rust and corrosion, and resistance to hot water at faucet temperatures. Polystyrene met all these requirements and, in addition, was supplied in a wide range of beautiful colors which would serve to add a cheerful note to the kitchen.

The special patented filter disk which is screwed into the lower part is really the heart of the unit. This has a base of textile material and a top layer of powdered charcoal which are molded together under pressure. When water filters through this disk, suspended matter is removed. At the same time, the taste of chlorine and other foreign substances is absorbed and any disagreeable odors are removed, yielding water that is clear and palatable.

The man who designed the Cambridge cigarette lighter had women on his mind. Because women don't like to pick up an object that is cold, the lighter is housed in Catalin, a material that like other plastics, is warm to the touch. Because they have small hands and small handbags, the unit is small and compact in size. And because women are keenly color-conscious and adore costume-matching accessories, the lighter comes in a splendid array of hues with such fanciful names as cranberry, royal blue bell, ebony and saddle.

Fabrication of the cast phenolic is done by Geometrix Mfg. Co. who saws bars of the material into the proper lengths for the main part of the housing, polishes them to a nice sheen and drills a circular hole that will contain the lighter fluid. The cast phenolic for the top part of the lighter is sliced from rods with a width equal to the desired length of the small piece and rounded enough on the edges to need no machining except for the milling of the angle needed to accommodate the hinge. Holes for screws are drilled and the plastic pieces are sent to Hygrade Assemblies Mfg. Company, the designer and manufacturer of the lighter. Here the metal parts are gold plated for a luxurious finish and the whole unit is assembled.

The choice of cast phenolic for this application was no accident. The designer reasoned that the plastic material, being lightweight, unaffected by lighter fluid and relatively non-inflammable, has all the advantages of aluminum, the metal commonly used for lighters, and yet is easily fabricated and can be made up in any of a wide range of 115 different colors and shades, to say nothing of multitudinous two-tone combinations. The moderate price of the lighters is especially appealing to women who wish several to go with different costumes. Distributing is by J. J. Sperans Co.



PRODUCTS

S. Stroock and Co., Inc., makers of textiles, required a retail store display which would impress the customer with the fact that quality is linked to the company's name. The piece could not be large enough to feature actual swatches of cloth in any variety. Yet it had to show fabrics in color as naturally as possible.

A solution was found in two plastics—Ethocel and Vinylite. The Lawrence C. Gumbinner Advertising Agency worked out an idea of using a knockdown fiberboard display to frame a semi-impressionistic translucent picture, painted on a sheet of ethyl cellulose, of three unrolled bolts of Stroock fabrics displayed as if draped around three models. The display, backed by a stiff sheet of translucent vinyl, was to be lighted from the inside to show the colors and texture of the goods.

The Hopp Press, Inc., which was called in to handle the printing, found that because of the coarse engraving screen and the characteristics of the transparent inks selected for the job, certain printing values were lost. This was remedied by "hitting" the sheet with an extra tone of red and one of green—making six impressions in all. Printing was done on the inside of the front sheet, the white translucent sheet serving to disperse the light softly through the picture.

* Reg. U. S. Patent Office.

Seeing through a subject

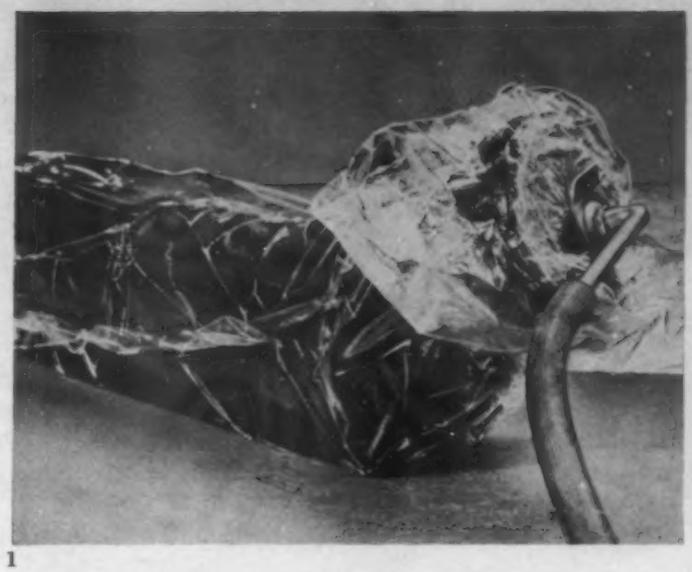
BY printing pictures or drawings of different parts of a unit on separate transparent cellulose acetate sheets, then superimposing them, it is possible to quickly and easily visualize the make-up of that assembled unit. This method of clarifying a product or process has been applied to problems ranging all the way from mechanics to color by X-Ray Sales Methods. Pictured in this manner, a refrigerator or diesel engine may be opened up and its method of operation clearly observed, even by those without a special mechanical background. Some of the most striking applications have been in the home decoration field, in booklets which enable the customer to try different furniture, rug and paint combinations so that color harmonies and other decorative considerations may be studied in miniature and decided in advance. Salesmen's visualizers, dealers' counter books, store displays, and folders also lend themselves to this type of treatment.

Lumarith sheeting of 0.001 in. thickness has been the principal transparent material used in these booklets. Before being printed, the sheeting is laminated to die-cut paper or paperboard by the Arvey Corporation with its Lamcote process. In this method, the acetate film covers not only the die-cut window section of the sheet, but extends completely to the edge, imparting extra strength to the paper and providing an attractive protecting film over any printing previously applied to the paper. The laminated construction of the sheets gives them sufficient body to be handled on standard press and binding equipment and facilitates maintenance of accurate register in the printing process.

Following the lamination and trimming of the sheets, the acetate is printed letter-press with special oil inks in the desired color or colors. The material is printed on either face, according to the requirements of the particular booklet or manual. After printing, the laminated sheets are gathered and fastened together with sturdy plastic or wire binding which holds them in alignment and permits them to be freely turned. The binding may run along a single edge of the booklet or along two or more, depending on the relative complexity of the presentation. With various sections bound on different sides, it is possible to interleave the printed acetate sheets in a number of ways, as, for example, in a booklet in which different wall colors, rug patterns, draperies and pieces of furniture are tried together to test the combinations.

There appears to be no physical limit to page or unit size of the booklets printed by this method. Books with page sizes as large as 36 by 36 in. are being used effectively as store displays and in sales meetings. In these larger booklets, 0.010-in. acetate sheeting is employed instead of the lightweight film. No lamination process is used; instead, the sheeting is printed, cut out with a safe margin beyond the printing, and stop-glued in position on die-cut sheets of paperboard stock, producing a window effect.

During the war, X-Ray Sales Method supplied approximately 7000 X-ray propeller manuals to the Army Air Forces for use in classes studying the construction of propellers. This company is now studying the possibility of utilizing this method in the printing of school textbooks—from picture books for the lower grades to presentations for physics students.



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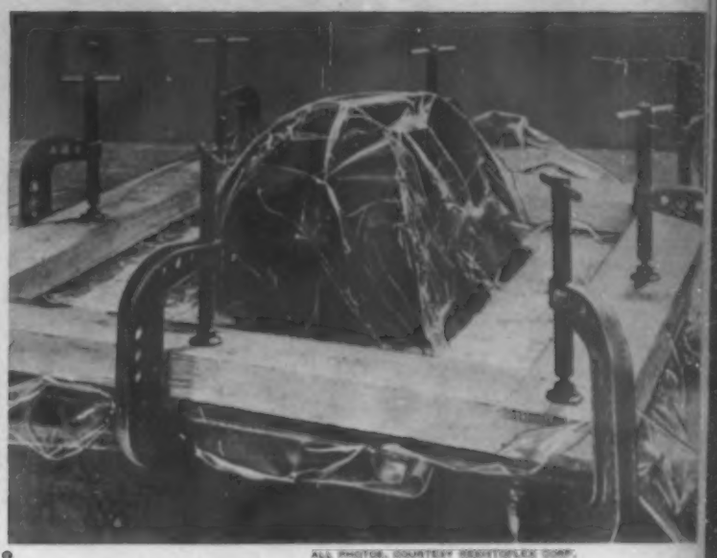


2

ALL PHOTOS, COURTESY RESISTOFLEX CORP.

1—In this method of low-pressure molding, the laminate is vacuum sealed in a vinyl bag and put in a curing oven.
2—Or a vinyl sheet may be put over the laminate, a vacuum drawn and the assembly cured in an autoclave

Vinyl bags for low-pressure molding

By means of vacuum bags of vinyl resin sheeting, low pressure laminates can be produced quickly and inexpensively. The process consists of wrapping a slush molded plaster core with successive layers of resin-impregnated glass fabric, setting this laminate into a bag of vinyl material which is then vacuum sealed, and curing in an oven under moderate heat and low pressure.

HERE'S something which should interest industries reconverting to peacetime production. It's a new technique, recently developed, that drastically cuts the time and cost of designing and producing low-pressure laminated parts through the use of vacuum bags made of compar, a vinyl resin derivative. Not only do these bags eliminate the need for costly dies but they offer advantages over metal or wood parts.

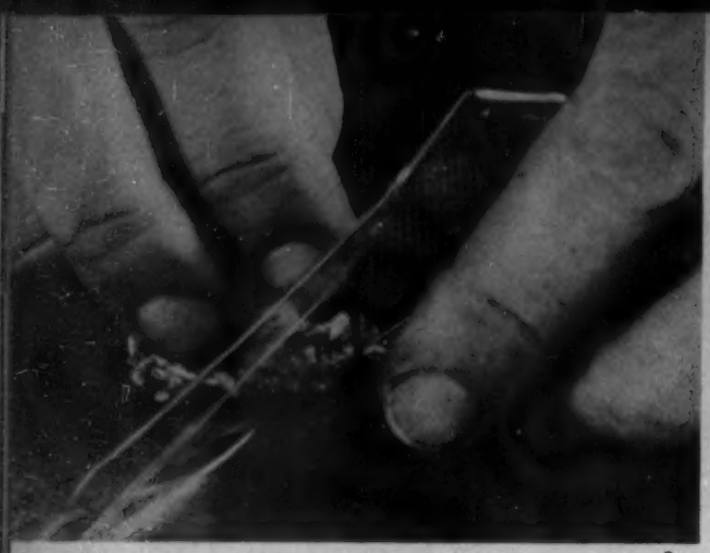
Owens-Corning Fiberglas Corporation is responsible for the successful application of sheets of this vinyl resin derivative to low-pressure laminating. Extensive experimentation, carried on in their research laboratories, brought about its use in developing prototypes of low-pressure laminates which were light of weight, strong, rigid, and which could be fabricated inexpensively and in a hurry.

Flexibility, elasticity, transparency and immunity to oils and solvents were the qualities of compar which made it specially adaptable to use in the laminating process. Furthermore, when made into vacuum bags it does away with any need for special tailoring since it fits close to the laminated part however complex the contour may be. This sheet material's toughness permits wrinkling of the vacuum bag without prohibitive wrinkling of the laminate. Also, because of its resistance to wear, there is no danger that the sheet will break when the vacuum bag is formed. And, finally, the transparency of the bag is a great aid in detecting and eliminating air pockets when the vacuum pump is put in operation.

Here is the new technique as worked out by the glass fiber manufacturer. A plaster of Paris cast is made of a wood pattern of the desired part. Then a slush-molded core is lifted from this cast. This is the form over which the resin-impregnated fabric is laminated. A coat of lacquer, followed by one of polyvinyl alcohol solution, insulates the hollow plaster core from the synthetic resin.

From the form, into the bag

When the block is completed, it is wrapped successively with the required number of pieces of Fiberglas cloth trimmed to fit the form. Each layer of cloth is brushed with liquid resin until the desired thickness is obtained. Heavy, loosely woven cloth produces the best mechanical bond, requiring fewer plies of glass fiber. Compound curves also are more readily accommodated when loosely woven cloth is used, and the flow of resin through the cloth—for dimensional stability—is greatly facilitated. All vegetable oil must be removed from cloth before lamination to secure maximum strength. *(Please turn to next page)*



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3—To seal the vinyl bag, a moist cloth is rubbed lightly over the surface to be sealed. Tackiness of the vinyl insures an air-tight seal. 4—The edges are then joined and pressed into intimate contact to secure bonding

After the laminate is formed it is set into a compar bag that is open at one end. This bag or casing is then wrinkled to conform closely to the shape of the part and sealed by dampening the edges of the material and pressing them together. The tackiness of the damp vinyl resin ensures a vacuum seal. A hole is cut in the bag, and the vacuum fitting installed, a few plies of vinyl sheet being used as a gasket under the top washer to prevent leakage. Applying the vacuum pump, all air is exhausted from the bag. Atmospheric pressure squeezes out any remaining air pockets and excess resin, leaving the vinyl bag fitted to the laminate.

Curing and finishing

Now the laminated part is ready to roll into the curing oven where polymerization of the resin is completed. The heat required ranges in most cases from 180 to 250° F., depending upon the resin used. The pressure needed to keep the laminations in close contact with each other ranges from 0 to 15 p.s.i.

When curing is completed, the laminate is allowed to cool before it is separated from the form block. The finishing touches are then put on the completed part—flanges trimmed, holes drilled or clamps installed according to specifications.

Other methods besides the standard one just described also have been developed for curing laminates with the help of vinyl resin sheet. One method is to place the laminate on a table with a large sheet of the vinyl over it, the edges clamped with a wooden frame. The entire assembly is cured in an autoclave after a vacuum is drawn.

The advantages of revolution

Revolutionary in the field of low-pressure laminating, this application of vinyl resin sheeting offers many advantages. Plastic tools laminated in this manner are completed in a fraction of the time formerly required, with correspondingly great savings in the development of new designs. Particularly for small quantities of fabricated parts, estimates have been found to be lower than they are for metal, wooden or cast phenolic tools. With production time drastically cut and the cost of new designs also low, important savings are effected in procuring lightweight, strong parts to speed postwar reconversion.

5—A small hole is cut in the vinyl bag to allow for the valve stem of the vacuum fitting. 6—When vacuum pump fitting is installed, plies of vinyl sheet are used as a gasket underneath top washer to prevent leakage

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Officers and council members of S.P.E. Front row, left to right, T. E. Orr, G. W. Clark, H. J. McGowan, J. Reinecke. Back row left to right, R. B. Bower, W. C. Goggin, P. R. Marvin, J. H. DuBois, T. E. Richards, B. C. Stupp. H. C. Josephson was not present when photo was taken

S.P.E. annual convention and exhibit

MARKING the new year's first large-scale activity by organizations in the plastics field, the second nation-wide meeting and exhibit of the Society of Plastics Engineers, staged in Detroit on January 7 through 9, raised the curtain on what may well prove to be the most notable year of peacetime progress in the history of the industry. The S.P.E. gathering was held concurrently with the annual meeting of the Society of Automotive Engineers in Detroit, affording automotive technical men an opportunity to obtain a quick overall picture of plastics development.

Meetings were held in Detroit's Horace H. Rackham Memorial Hall, while the general display filled approximately 70 booths in nearby Convention Hall. The exhibit was supplemented by MODERN PLASTICS' large traveling display.

New officers of S.P.E.

At the S.P.E. election of officers on January 7, George W. Clark, *Owens-Illinois Glass Co.*, was named president of the organization for the ensuing year. Other officers elected included Harry J. McGowan, *Bakelite Corp.*, vice-president; Thomas E. Orr, *Plastic Engineering, Inc.*, secretary; and Jean Reinecke, *Barnes & Reinecke*, treasurer. Added to the list of S.P.E. council members were R. B. Bower, *Delco-Remy Div., General Motors Corp.;* J. H. DuBois, *Shaw Insulator Co.;* Philip R. Marvin, *Milwaukee Gas Specialty Co.;* and B. C. Stupp, *Delco Products Div., General Motors Corp.*

In his report for 1945, William B. Hoey, retiring S.P.E. president, recommended the creation of an executive committee to handle routine business matters; a proposal that a fund be set aside for a part-time fellowship for research, and another calling for organization of branches of the Society in accredited technical schools offering courses in plastics. Mr. Hoey also recommended the establishment of a scholarship or loan fund to foster technical training in plastics and the creation of an education committee.

Two exhibits paint up interest

The variety of exhibits shown at Convention Hall contained much of interest to both the seasoned plastics veteran and members of the general public.

The MODERN PLASTICS educational traveling exhibit, comprising approximately 1000 items, was a center of interest between and after technical meeting sessions in Rackham Hall.

Technical sessions held during the three-day meeting covered materials, molding techniques, laminates, tool and product design, coatings, consumer specifications:

An all-over photograph of the general plastics exhibition which filled approximately 70 booths in the Convention Hall

Material session

DR. S. D. DOUGLAS, *Carbide & Carbon Chemicals Corp.*, speaking on "New plastic development in the U.S.A. during the war," traced recent improvements in materials and processing techniques. He laid special emphasis on progress made with vinyl chloride acetate copolymers, different types of dispersions, polyethylene, polystyrene, copolymers of styrene and butadiene, vinylidene chloride, polytetrafluorethylene, and certain allyl resins.

ALEXANDER NIXON, *Fisher Body Div., General Motors Corp.*, in his talk on "Plastic materials in automotive construction," reminded listeners that continued and expanded applications in this field must be based upon plastics' contributions to the value of the finished car.

DR. H. A. WINKELMAN, *Dryden Rubber Co.*, speaking on "Plastics in the rubber industry," wound up the session on materials with a comprehensive discussion in which he reviewed the use of plastics by the rubber industry in the manufacture of products for various industrial and household applications.

Molding technique session

W. C. GOGGIN, *Dow Chemical Co.*, compared German and U. S. fabrication methods and special products fields of injection, compression, extrusion, films and sheets, coatings, fibers, pastes and foams in his speech, "German plastic fabrication methods."

W. S. PRENDERGAST, *Carter Products Corp.*, in a talk on "Special extrusion molding," described a method by which a standard extrusion machine can be utilized to mold parts from thermoplastic materials. He explained that the extruder is coupled through a nozzle to a die and that the material is forced into the die by normal action of the extruder screw, after which the piece is allowed to cool and is ejected in a normal manner.

Laminates symposium

SIMON WILLIAMS and E. V. PAINTER, *National Cotton Council*, started off this session with a paper on "Cotton in relation to laminates." This discussion covered some physical properties of cotton fibers, yarns and fabric which influence their utilization in plastic laminates.

C. F. MARSCHNER, *Forest Products Laboratory*, reviewing "Semi-structural fabrications," described plastic laminates having paper and paper-like fillers and thermosetting resin binders.

H. COLLINS, *Owens-Corning Fiberglas Corp.*, spoke on "Engineering properties of Fiberglas reinforced plastics," emphasizing that the development of glass fibers as reinforcing agents now makes possible the utilization of plastics in many engineering applications from which they have heretofore been restricted by lack of suitable physical properties.

Second laminates session

DR. HARRY F. LEWIS, *Institute of Paper Chemistry*, discussed the characteristics and production of different types of paper used in laminating work, with particular reference to the effect of different types of resins.

DR. GORDON KLINE, *National Bureau of Standards*, reviewing "Developments in plastics in Germany during the war," gave a slide-illustrated talk on the production of Compreg-like material and vulcanized fiber.

C. WOELLERT, *American Cyanamid Co.*, in his discussion of "Decorative laminates," reviewed the comparative properties of amino plastics and the copolymer or anhydrous resins used in their production. He visualized a steadily expanding market for these laminates on the strength of their beauty and utility.

T. WALTER NOBLE, *Fabricon Products, Inc.*, spoke on "Low-pressure molding—materials and techniques." Augmented by slides, the discussion covered basic materials and methods and emphasized recent advances.

DR. E. R. PERRY, *Westinghouse Electric Corp.*, in his talk on "Resin and raw material characteristics from a laminator's standpoint," declared that an almost limitless variety of materials was now available to the laminator. But he reminded his listeners that the materials are valueless unless structure resulting from their combination can be sold at a competitive price.

R. J. METZLER, *Hercules Powder Co., Inc.*, in a final

laminates paper, "Thermoplastic laminates," outlined the development work being conducted by his company on thermoplastic laminates. Mr. Metzler described the no-pressure and low-pressure methods now being used in the industry.

Tool design

B. F. HANTZ, *American Insulator Corp.*, delivered the first paper, "Compression and transfer molds." He traced the fundamental operations involved in making a mold, using slides to illustrate its evolution from the product idea stage to the point of completion.

W. W. BROUGHTON, *National Lead Co.*, had as his subject, "Kirksite plastic molding tools." He stated that in his opinion the biggest possible field is that of low-pressure compression molding either with a rubber bag or with a solid punch and die.

CLINTON RECTOR, *Catalin Corp.*, wound up the tool design phase of the program with a discussion on "Tooling aspects of cast plastics." In addition to the industrial uses of cast phenolics, Mr. Rector described civilian outlets for this material. He went on to point out the economy of tooling up for cast plastics.

Castings session

P. F. CORBIN, *Textileather Corp.*, speaking on "Plastics as coatings," discussed thermoplastic resins as applied to cloth of various kinds, explaining the 6 general types of coatings but confining the particulars of his talk to nitrocellulose and copolymers of vinyl resins.

DAVID S. PLUMB, *Monsanto Chemical Co.*, spoke on "Polyvinyl butyral coatings," pointing out that although this resin is relatively old in the plastic field, it is now finding new and different uses.

F. T. MARX, *Monroe Auto Equipment Co.*, in discussing "Metal plating over plastics," described the advantages often gained from this combination of plastics and metals and summarized techniques as metal spraying, vacuum deposition and chemical reduction.

DR. THOMAS HILL, *Aluminum Co. of America*, speaking of "Plastic coatings for metals," dealt largely with the use of thermoplastic films over aluminum foil as a means of enhancing the foil's utility when used in packaging.

Consumer specifications

G. F. CLARK, *Owens-Illinois Glass Co.*, took as the subject of his talk, "Consumer specifications and their applications." Mr. Clark pointed out that at each successive stage in its production, the company or individual purchasing the material for subsequent processing is in effect a consumer who in turn becomes a supplier. Mr. Clark gave closures as an example of a product on which the consumer exerts strong specification influence.

N. RAKAS, *Chrysler Corp.*, speaking on "Industrial aspects of consumer specifications," pointed out that satisfactory plastic applications depend largely upon adequate control, and that the consumers' means of control rests with their specifications.

F. A. MARTIN, *The Hoover Co.*, in his paper, "Stability of phenol-formaldehyde plastics," described the results of tests on the dimensional stability which indicated that the amount of swelling experienced is dependent on the type of filler used. According to the speaker, moisture absorption does not take place at 50 percent relative humidity, so there is little danger of dimensional change under atmospheric conditions.

A note of humor was injected into the proceedings when a speaker identified as Dr. Heinrich Bulchdorf of Barnes & Reinecke, industrial design firm, presented slides of a number of "Products of the future" such as a combination radio-washing machine and 3-speed double-action spaghetti fork. The diverting presentation was climaxed when "Dr. Bulchdorf" revealed his true identity as a radio actor.

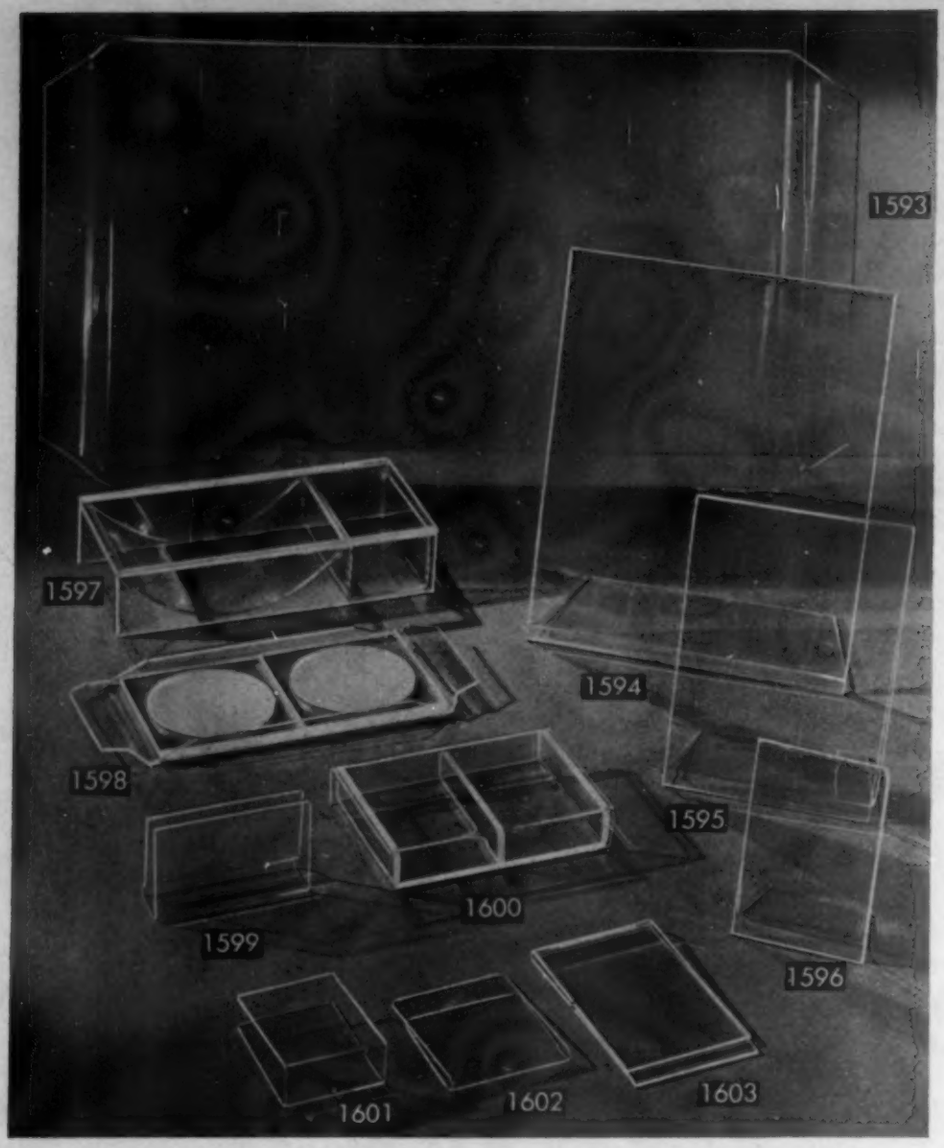
JOHN SASSO, managing editor of *Product Engineering*, in the closing speech of the session on product design, spoke on "What design engineers expect of the professional activities committee of the S.P.E."

CHARLES HENRY, *Chicago Die Mold Mfg. Co.*, discussed "Product design from a molder's standpoint" and outlined five fundamentals important in this work.

A section of the Modern Plastics display which was divided into three main parts dealing with plastics in the home, in industry and at war. It was shown in the Rockham Hall where the technical meetings were held

All molders and fabricators are invited to send samples of stock and proprietary items to appear on this page as space permits.

Stock Items 1-1582 appear in the Plastics Stock Mold Catalog, 1944, available at $5.



Plastics Stock Molds*

SHEET ONE HUNDRED THIRTY-FOUR

1593. Tray formed from single sheet. Overall length 22 in., 12 in. wide

1594. Two-sided standing picture frame formed from single sheet; 10 in. high, 8 in. wide

1595. Two-sided standing picture frame, formed from single sheet; 7 in. high, 5 in. wide

1596. Two-sided standing picture frame, formed from single sheet; 4 in. high, $2^3/_4$ in. wide

1597. Cigarette box with sliding cover. Two compartments, one rectangular and one concave. Overall dimensions, $8^1/_4$ in., $1^3/_4$ in. Concave compartment 6 in. long

1598. Coaster tray fitted with 2 separate coasters. Tray $3^3/_4$ in. wide, $9^1/_4$ in. long. Coasters $3^1/_2$ in. square with 3-in. diameter center. Tray formed from single sheet.

1599. One-piece playing card holder, suitable for 1 deck. $3^1/_2$ in. high, $2^1/_4$ in. wide, $^3/_4$ in. deep

1600. Two-deck playing card box with sliding cover. Overall dimensions 5 in. by $3^1/_2$ in. by 1 in. deep

1601. Cigarette package holder formed from one sheet. $2^3/_4$ in. square, 1 in. deep

1602. Money clip formed from single sheet; 3 in. long, 2 in. wide

1603. Pocket-sized picture frame formed from single sheet; $4^1/_2$ in. long, 2 in. wide

* Reg. U. S. Patent Office.

Beryllium copper as a mold material

Beryllium copper molds, whether sand cast or cast under pressure with a master die, stand up well under corrosive action of some plastics and are low in cost, an important factor in novelty parts

by LAWRENCE F. BOLAND†

WITH few exceptions, wartime restrictions on the applications for beryllium copper prevented its use by the plastics industry. There was more urgent need for the metal in vital aircraft, radio and radar parts where no other material would serve as well. However, this military service is responsible for many advances in methods of processing this metal and in the standardization of the fabrication and heat treatment of the finished parts.

Availability and range favor this alloy

Today, beryllium copper alloys, in both the cast and wrought forms, are readily available to the plastics industry. In fact, deliveries of mill and beryllium copper foundry products are considerably better than those of most of the copper base alloys.

But aside from availability, this material offers several other advantages to the plastics molder and mold maker. Inasmuch as the general field of plastics covers not only different methods of molding but many different types of plastics—some of which have rather high corrosive action on the molds—there are limitations on the use that can be made of any one particular alloy. The manufacturer of molded parts usually must consider carefully the type of plastic that is to be used, the production method that is most practical, the design of his molds, etc., before he can take even the first step in the actual production cycle. And when this analysis has been made, beryllium copper is found to stand up well in comparison with other mold materials, either as a sand casting or as a mold cast under pressure with a master die.

Low cost of beryllium-copper molds

Cost is another important factor in mold making. This is particularly true in the manufacture of decorative and novelty parts where the demand is constantly changing and the need is for an unusually large number of different molds, many of which will be used for rather short runs. The cost of machined steel molds for parts of rather intricate designs is considerable and deliveries of such molds are relatively slow.

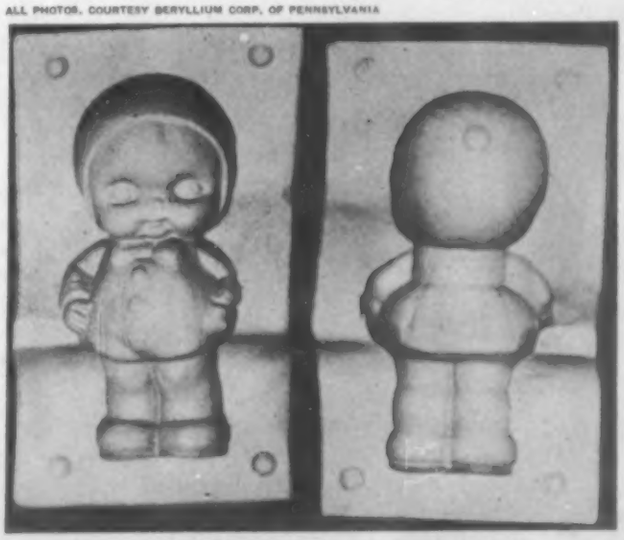
Beryllium copper has two distinct features that make it attractive for molds of this type:

1. Unlike steel, the 2 to 3 percent beryllium-copper alloys, when properly handled, can be readily cast in sand, plaster, centrifugally, by the lost wax method or by the pressure casting procedures.

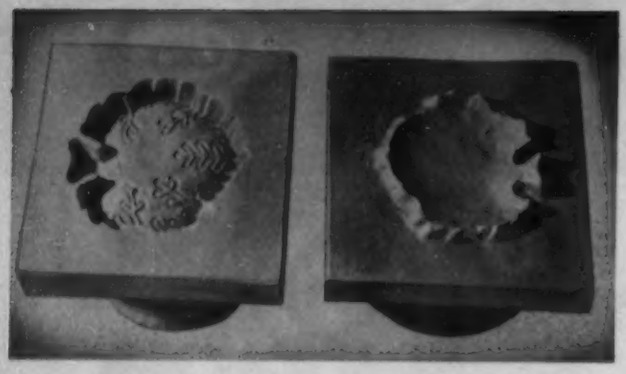
2. As is now fairly well known, the beryllium-copper alloys can be hardened by a relatively simple 2-step heat treatment to hardnesses equivalent to those of medium carbon and alloy steels. Thus beryllium-

1—Beryllium-copper molds can be made economically from sand castings which have been formed around plaster patterns

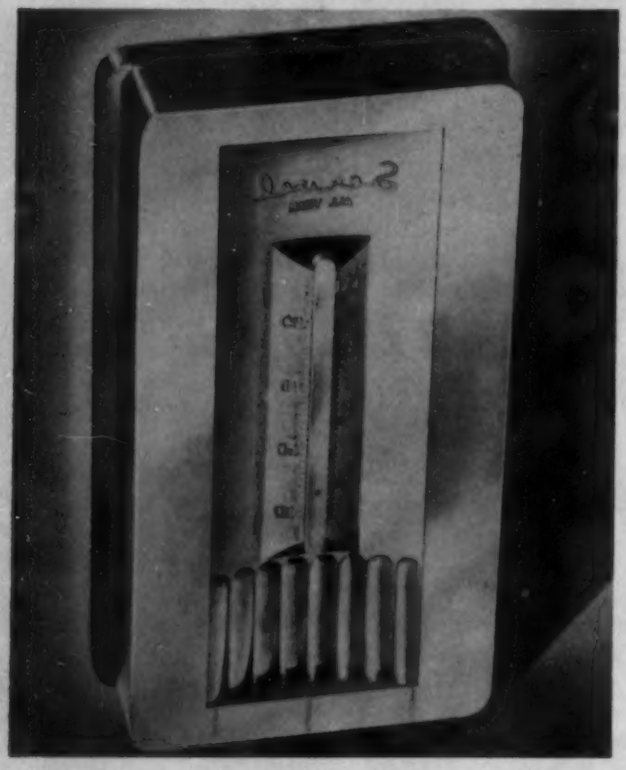
ALL PHOTOS. COURTESY BERYLLIUM CORP. OF PENNSYLVANIA



† Beryllium Corp. of Pennsylvania.
* Reg. U. S. Patent Office.



2—If beryllium castings are to have detail, as in this ash tray mold, the proper pattern and fine sand must be used



3—Typical of the clear detail and smooth surface which can be obtained in a beryllium-copper mold by hot hobbing is this thermometer which is used in a Servel refrigerator

copper molds will stand up under any of the pressures used in the various types of molding and yield a good production run without appreciable wear.

The usual practice in making cast beryllium-copper molds is to construct a wood or aluminum pattern with allowance for $^3/_{16}$ in. per ft. shrinkage. From this pattern the mold is cast with allowance for a $^1/_8$- to $^3/_{16}$-in. finish. In making castings of this type, particularly when wood or plaster patterns are employed, the pattern must be prepared with care since the surface and definition of the casting will be no better than that of the pattern. Ordinarily, very fine sand is used so machining and polishing can be kept at a minimum.

After the cast molds are cut off and cleaned, they are given what is known as a solution anneal and quench. This treatment softens the metal so that it can be readily finish machined. Then, the trimming up of the design and mold surface completed, the piece is hardened. This is usually accomplished by holding the mold for several hours at 600° F. in practically any type furnace, following this by air cooling. Depending on the alloy used, age-hardened molds will have hardness ranging from Rockwell C-42 to C-48. The mold is then chased and polished for production use.

Hardening the alloy

Fortunately, the process of hardening beryllium copper is exactly the opposite to that of steel, that is, the quenching treatment, where the greatest danger of dimensional change exists in heat treatment, is performed before the mold is finished. The hardening treatment is a low-temperature air-cooling treatment that offers none of the risks involved in the quench hardening of steel.

It should be pointed out that in the precipitation hardening of beryllium copper, the alloy hardens consistently and uniformly throughout the metal. Consequently, it offers a far greater compressive strength in the core than does the best carburized alloy steel.

Cast beryllium-copper molds can be obtained from some foundries with quick deliveries, cutting down the time required to obtain a finished mold. And the scrap value of obsolete or useless beryllium-copper molds is high since the metal can be used over and over again in the same foundry. In this way the user of beryllium-copper molds can salvage part of the initial cost by reselling the scrap mold back to the supplier.

Figures 1 and 2 show molds produced as sand castings. By the use of the proper type of patterns and fine sand unusually good surfaces can be obtained so that relatively little finishing is necessary. These particular castings were produced from plaster patterns. Figure 1 is a kewpie doll, Fig. 2 a novelty ash tray.

A question has been raised as to the suitability of beryllium copper for molds operating at elevated temperatures or under alternate changes of temperature as encountered in the molding of phonograph records. In a typical molding operation of records, the mold heats up to as high as 300° F. and cools off to 120° F. in each cycle. In one plant, a 35-ton press is used which closes approximately 1000 times per day. If the properly selected alloy is used, heat-treated beryllium-copper molds will stand up under such temperature changes.

The temperature limitations in the use of beryllium copper are controlled by the final age-hardening treatment. This is due to the fact that the hardening temperature will gradually over-age or soften the alloy. The curve on this behavior depends on the nature and type of alloy. Generally the higher the beryllium-content in a beryllium-copper alloy the lower is its temperature resistance. For example, the standard 2 percent beryllium-copper wrought alloys

are hardened at 600° F. It is not recommended that these alloys be used for temperatures exceeding 400 to 450° F. depending on the duration of the temperature.

In the case of the cast alloys of the same beryllium content, however, it is possible to make additions of other elements that normally would not be possible in the wrought alloys. These additions considerably extend the hardening curve so that the cast alloys can be used safely at slightly higher temperatures than the wrought alloys of the same beryllium content. The 0.50 percent beryllium-copper alloys such as Trodaloy #1 are hardened at temperatures of approximately 900° F. This alloy can be safely used to as high as 700 to 750° F. Again, the maximum temperature which is allowable depends on the circumstances and the length of time the metal is subjected to the top temperature.

Effect of copper content

Both the cast and the wrought beryllium-copper alloys commercially available today contain more than 97 percent copper. This means that many of the desirable properties of copper are present. Due, in great part, to this high copper content, the alloys have a relatively high electrical and thermal conductivity. The thermal conductivity rating is more than twice that of mold steel. In some molding operations this is a distinct advantage in speeding up the heating and cooling cycle so that production can be stepped up without affecting the life or wear of the mold.

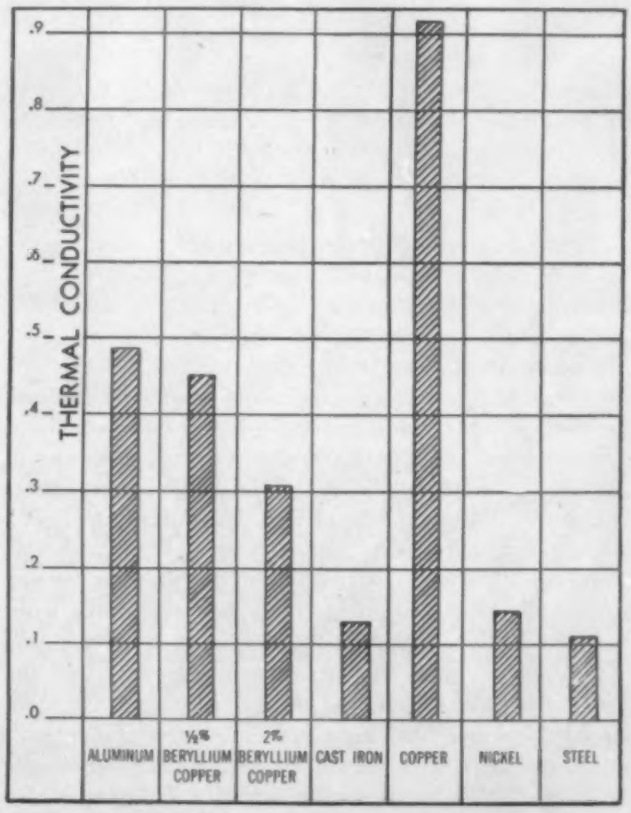
In the field of plastics where large industrial parts are molded to rather rigid tolerances—sometimes in tenths of thousandths of an inch per inch—beryllium copper has limited use. But even in applications of this type beryllium copper was found to be of use when molding a thermoplastic material which was found to corrode unprotected steel. It was a question of using either stellite finished mold parts or heavy chrome protective plating if molds were made from steel similar to SAE 3312. Beryllium copper, however, was not affected by the phosphoric acid given off by this plastic. Because of the unusually large size of these particular molds they were produced from forged beryllium-copper slabs and machined by the methods ordinarily employed when steel is used.

Beryllium copper, like most copper base alloys, can be readily plated with cadmium, silver, chromium and other metals. In some cases where unusual corrosion problems exist, beryllium-copper molds have been chrome plated. In molding rubber products where some types of rubber stick to the steel, it was found that with a cadmium-plated beryllium-copper surface there was no adhesion of the rubber to the metal.

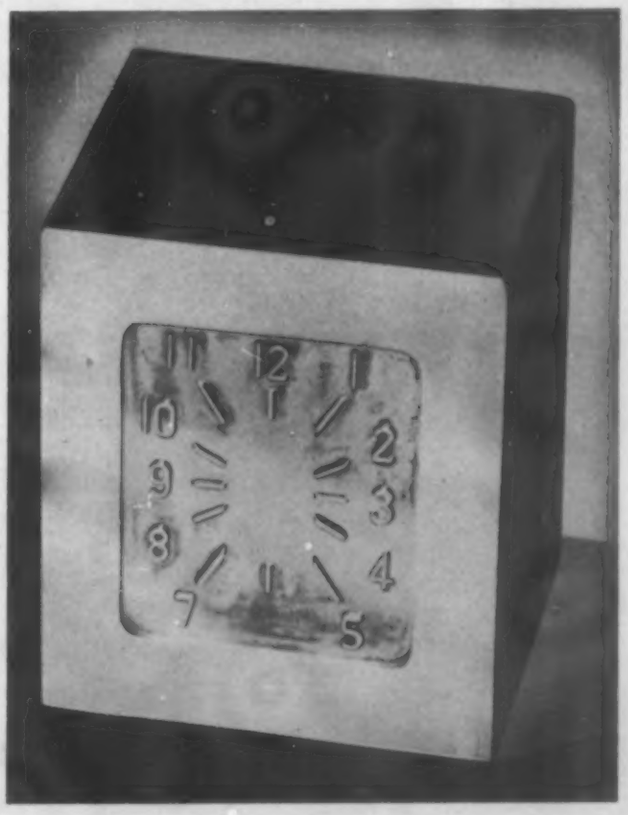
Pressure casting of molds

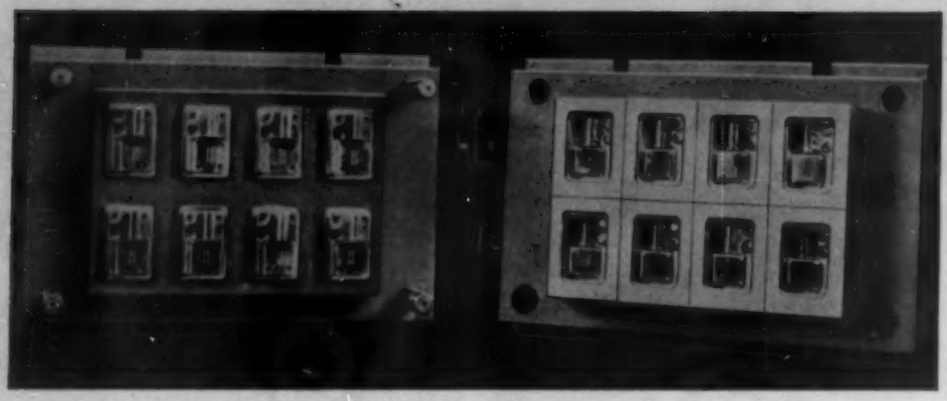
Probably the most extensive use of beryllium copper in the plastics industry to date has been for molds produced by the so-called pressure casting or hot-hobbed method. This is a process in which beryllium copper

4—Comparative thermal conductivity of 7 different metals



5—Beryllium clock face mold produced by hot hobbing





6—This hobbed beryllium copper multiple cavity mold for compression molding automobile ash trays is indistinguishable from one machined from wrought sheet

is cast under high pressure by a procedure similar to die casting. Beryllium copper (Berylco 20C and Berylco 275C alloys have been found most suitable, depending on the finished hardness required) is poured at a temperature as close to the lower melting limit as possible. The use of a press on the cooling metal provides a very dense structure with a finely polished surface and extremely good definition of the design.

Figure 3 shows a mold produced by the hot hobbed method. The thermometer piece used in the Servel refrigerator illustrates the clear definition and excellent surface possible with such beryllium-copper molds. It has been reported that with this process a finished beryllium-copper mold can be produced with a hardness two to three points higher on the Rockwell C scale than can be obtained with these particular alloys by any other method of casting.

Pressure-cast or hot-hobbed beryllium-copper cavities offer any one or combination of the following advantages to molders of plastic materials and of rubber goods:

1. Low initial cost of molds.
2. Maintenance of mold costs is kept at a minimum because an insert cavity, if damaged while in production, can be replaced at once by low-cost spare cavities kept on hand.
3. Beryllium-copper cavities can be heat treated to as high as 44 to 47 Rockwell C.
4. Cavities made by this process are degrowthed and of close grained construction.
5. Thermal conductivity of beryllium copper is twice that of steel. Therefore, where 2-cycle molding is being done, production can be stepped up.
6. Beryllium-copper cavities may be hard chrome plated if unusual circumstances make this desirable.
7. Cavities that are practically impossible to hob in steel can be produced by this process.
8. Intricate designs and irregular parting lines, and cavities with mold projections are no problem.
9. The compressive strength of beryllium-copper cavities made by this process is greatly increased.
10. Cavities are produced from master dies. Therefore, where multiple cavities of exact likeness are required, the cost is much lower than when steel is used.
11. When only a few cavities are required, the master hob does not have to be hardened.
12. Tolerances can be held to ±0.001 in. on most cavities.
13. Cast iron master dies can be used on some jobs, reducing the cost of master dies.

Other typical beryllium-copper molds formed by hot hobbing are shown in Figs. 5 and 6. The former is a clock face injection mold for the 1946 model Plymouth car; the latter, a multiple cavity mold of an ash tray to be used in compression molding. It is impossible to distinguish such molds from pieces machined from wrought stock.

Beryllium copper in hobbing

Beryllium copper has also been used for hobbing by the plastics industry. While it is relatively simple to hob beryllium copper with a steel master die while it is in the annealed soft condition before hardening, it has also been possible to hob steel with a hardened beryllium copper. In some cases when hobbing beryllium copper it has been necessary to re-anneal and quench the beryllium-copper piece during the operation. This can be done by heating the beryllium copper to 1450 to 1475° F. for a time ranging from 1 to 2 hr. This is followed by an immediate quench in water or oil. After this treatment the finished piece is given the usual hardening at around 600° F. and either air or furnace cooled.

One company specializing in injection molding reported that beryllium-copper cavities, when given a reasonable amount of care in handling, gave service from a die-wear standpoint equivalent to that of hardened steel. Another company using only the pressure molding process, normally harder on the dies than injection molding, reported runs on beryllium-copper molds of up to 60,000 pieces with the dies still in extremely good condition. This same manufacturer commented that the steel dies in equivalent service would normally turn out 250,000 pieces. In this business, however, it has been found that design changes are usually made before the steel die is worn out. Consequently, the die life is not a determining factor. The chief consideration is the saving in the cost of the mold itself, and the speeding up of the mold delivery cycle. As engineers and metallurgists continue to work with beryllium copper, additional uses will be found for it in the plastics industry.

Testing by sound

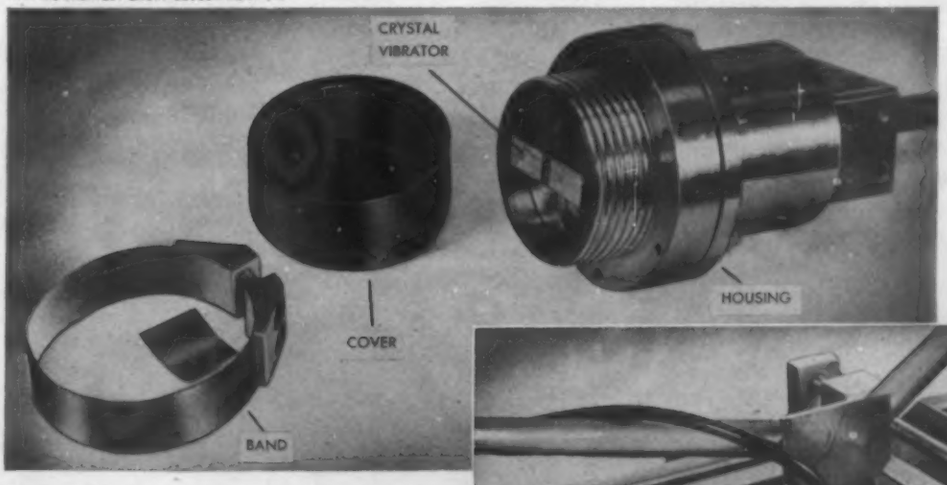
BRUSH Development Co. has announced a Hypersonic testing machine is now available to industrial users. The principle of the new tester revolves around the ability of a material to transmit sound. A steel plate is sometimes struck with a hammer to see if it rings true. The Hypersonic tester goes a step further—into the higher non-audible frequencies. By means of a receiver and a transmitter, using new sensitive crystals developed by Brush technicians, the unit translates sound passed through the material to be tested into electrical energy which is then amplified. Any interruption—any change in density or elasticity of the material is recorded and the piece is rejected.

While most applications of the device have been to materials other than plastic, the new Hypersonic tester will have many uses in the plastic field. It will detect voids in cable coverings or in extruded plastics. It will be useful in non-destructive testing of panels to be used in electrical installations. Most particularly will it be useful in testing cementing jobs done on opaque plastics. Even X-ray does not catch a void caused by poor cementing, while the Hypersonic tester reveals the weakness at a glance. It may be used to test adhesion in laminates, glass fiber sheets and low pressure moldings.

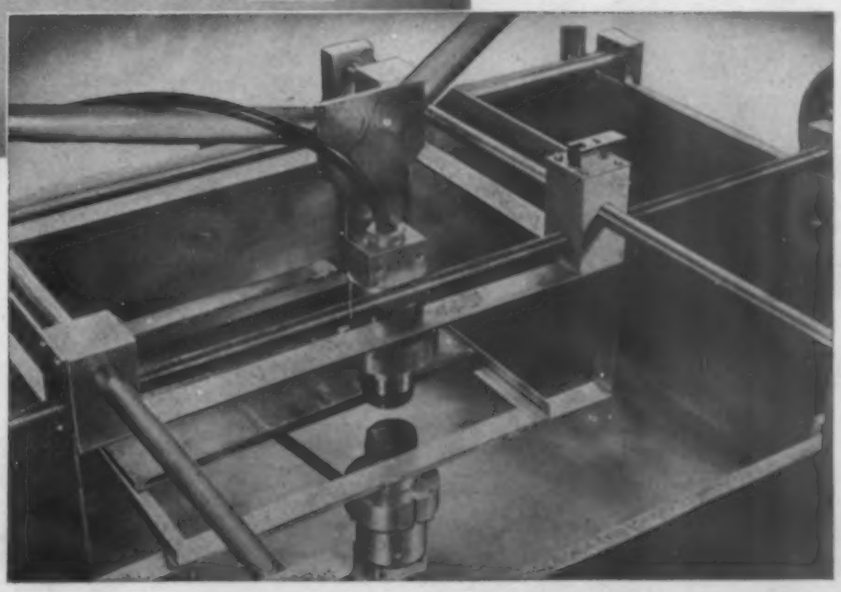
The field of Hypersonics as developed by the manufacturer of this unit is a most practical one since present electronic devices will catch and measure the speed of sound waves. (Light is too fast.) One application of the Hypersonic tester is in a "hearing stick" carried by a blind person which hears walls, counts steps and records obstructions in the path of the user. Another is in measuring the height of a blast furnace charge—now done by a system of weights and pulleys.

The whole development is based on the artificial crystals of Rochelle Salts. These crystals are relatively more efficient and active than quartz in translating mechanical into electric energy. Therefore they are now widely used in phonograph pickups, microphones and hearing aids. The Hypersonic tester saved tons of X-ray film in our war program and bids fair to be one of the most useful testing devices to come from our war experience. Each application is still relatively special and requires some engineering in the adaptation of the tester to the particular problem. But where continuous high-speed internal inspection of materials of more or less uniform section is required the Hypersonic principle may be profitably applied, not only by laboratories but by commercial users.

PHOTOS, COURTESY BRUSH DEVELOPMENT CO.

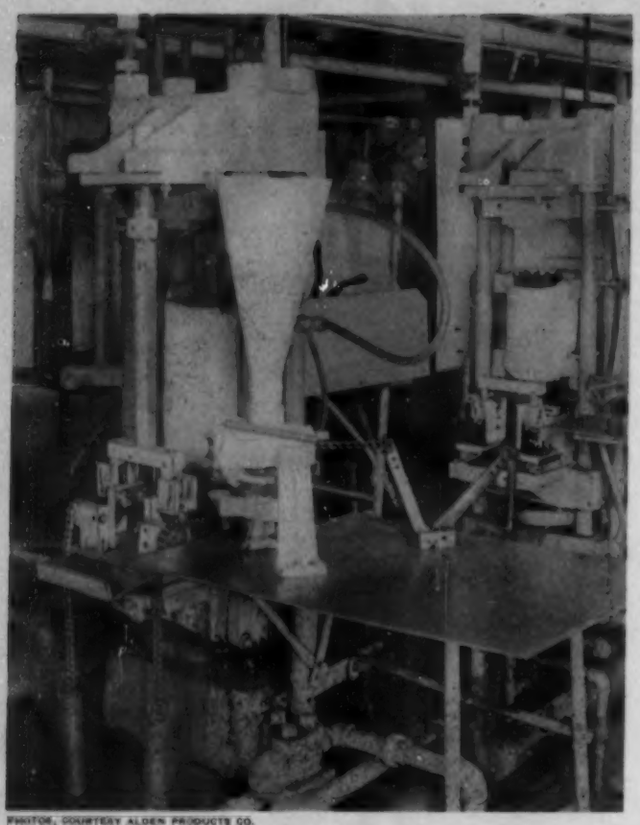


The component parts of a transmitter head of material testing machine. The cover is of rubber which has a density to sound which approximates that of water



2—This view of a testing tank shows receiver, transmitter and sample. The device translates sound passed through the material into electrical energy and amplifies it, instantly recording any change in density or elasticity of the sample. Defective pieces are rejected by automatic relays or marked by paint

Magazine molding and how it is done



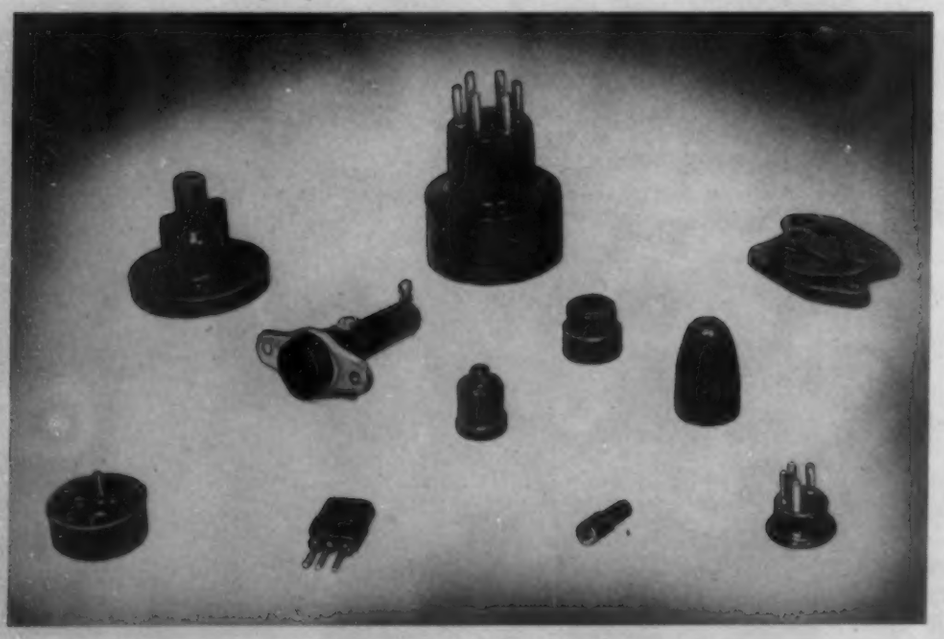
PHOTOS, COURTESY ALDEN PRODUCTS CO.

1—Here is a magazine press that has been stripped of its metal shell to show the spring-balanced chain synchronizing system, which operates the jig for taking apart mold, and hopper loading fixture. Both these parts are geared to the ram

A UNIQUE system of compression molding, known as the "magazine" method, is in use at Alden Products Company. Described by the company as being quite effective within the range of its use, the method involves cylindrical unit molds which move vertically in a compression-like piston. Each press complement of seven or eight molds has a spare which can be used in case of trouble. Woodflour filled phenolics are the principal materials thus far employed, although recently quite a bit of work has been done with low-loss electrical material. Thus far the method has been used chiefly for radio components.

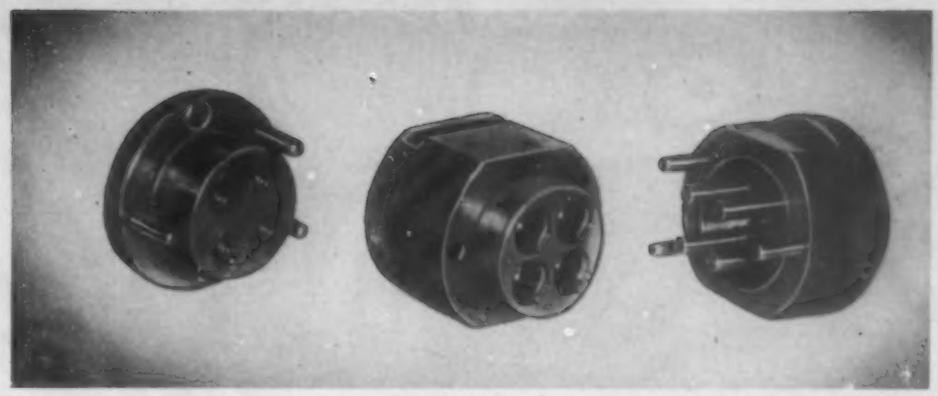
The most important advantage claimed for this system is that the pressure needed to mold eight pieces in unit molds in a vertical line, one on top of the other, is one-eighth the pressure needed to mold them if they were laid out horizontally in a multiple cavity. This means that a smaller press can be used than would be practicable were the same number of cavities laid out horizontally. Furthermore, the pressure is low enough so that the operator can remain seated and operate the press with a foot lever. Another advantage is that this process allows for short-run production of parts that might not otherwise be made of plastics because of mold cost in relation to quantity.

Work can be pooled on one or more presses. If an order calls for 30,000 units of one item, 80,000 of another and 50,000 of another for simultaneous delivery, unit molds are made in those ratios, and if one order should be doubled or tripled after production begins, the ratio can be changed without stopping production. If a cavity is damaged, work can go on without the loss in



2—Several samples of woodflour filled phenolic items for radios, which were produced on magazine presses. Note how tightly the metal inserts fit into the material

3—The unit mold is made from cylindrical steel stock in three pieces: base (right), female mold (center), top male mold (left). Male and female molds are designed to fit the disassembly fixture



down time occasioned by patching a cavity in a multi-cavity mold and without running empty cavities.

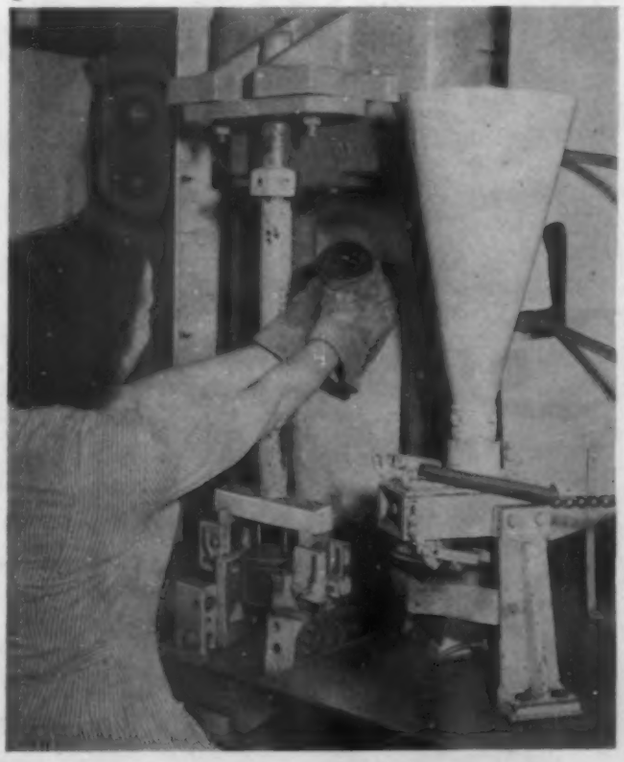
Each magazine holds seven or eight unit molds—depending on the height of each mold—one resting on the other. The molds are made in three parts (shown in Fig. 3); tooled out of cylindrical steel stock in diameters ranging from 3 to 8 inches. The operator, from a sitting position, fits the center female section of the mold on the mold base and places it under the spout or spouts of the conical hopper for loading (center of Fig. 1). The male top section is then fitted into position, and the assembled mold, loaded with material, placed over the last mold at the top of the cylinder (Fig. 4). Pressure released by a foot pedal sends the ram up into the magazine and at the same time lifts a cured mold (previously ejected to the jig at the front of the machine by the chain-operated pusher) up into the jig for emptying.

While the partial cure of perhaps a quarter of a minute is taking place, the mold in the opening fixture is emptied and placed below the hopper, ready for filling. Then the ram drops and the bottom or finished unit mold is pushed forward into the fixture. The six or seven remaining molds in the cylinder drop one stage, the new filled mold going in at the top again. Thus, cure time is the period it takes a unit mold to go from the cylinder magazine top to the bottom.

Naturally, "magazine" molding has its limitations. It is not recommended for tremendous runs. Since all pieces on one press must run on the same cycle for economical production, a large piece with particularly heavy section will have to be handled by individualizing one press or by running the piece through twice. It is not advisable to use this process where many delicate inserts are involved—but only normally strong metal inserts.

4—The loaded mold is lowered into the cylinder as a cured mold is ready for disassembly in the jig. 5—Mold at front is empty and male top about to be removed. Ram is descending and newly cured mold emerges at bottom

4



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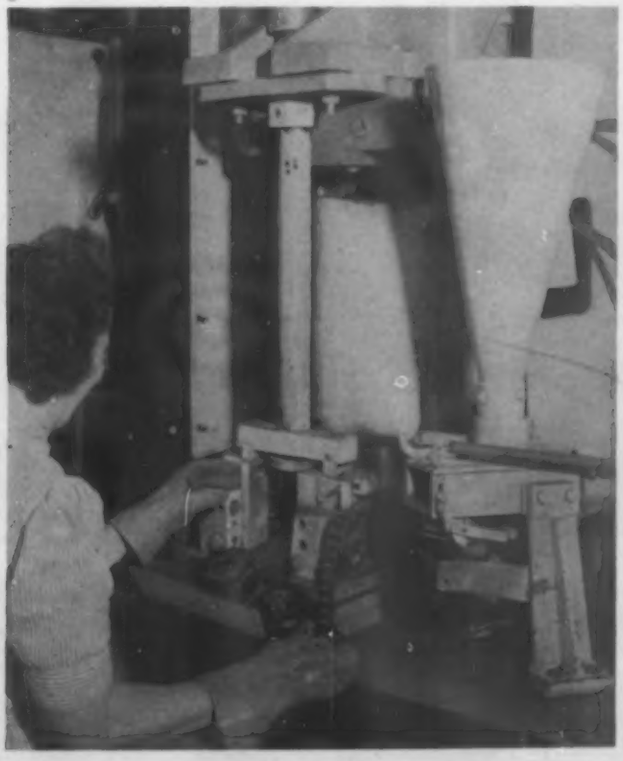

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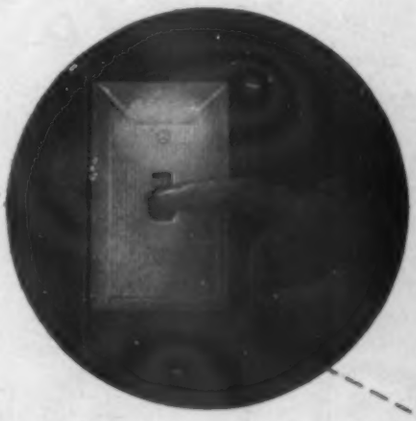
1

This new plastic pot cleaner, made by Downy Products Company, Orange, N. J., utilizes Plaskon Resin, a product of Plaskon Division, Libbey-Owens-Ford Glass Company. Thousands of tiny plastic beads are firmly anchored to minute cotton loops that hold soap while working at extreme speed. This provides power for scouring. The cleaner is wholly flexible and manageable, and will not crack, splinter or break off.

Of first importance is the fact that the new cleaner completely removes the hazards of infection that were constantly present when metallic cleaners were employed. These hazards were so real that several states passed restrictive legislation against the use of such cleaners.

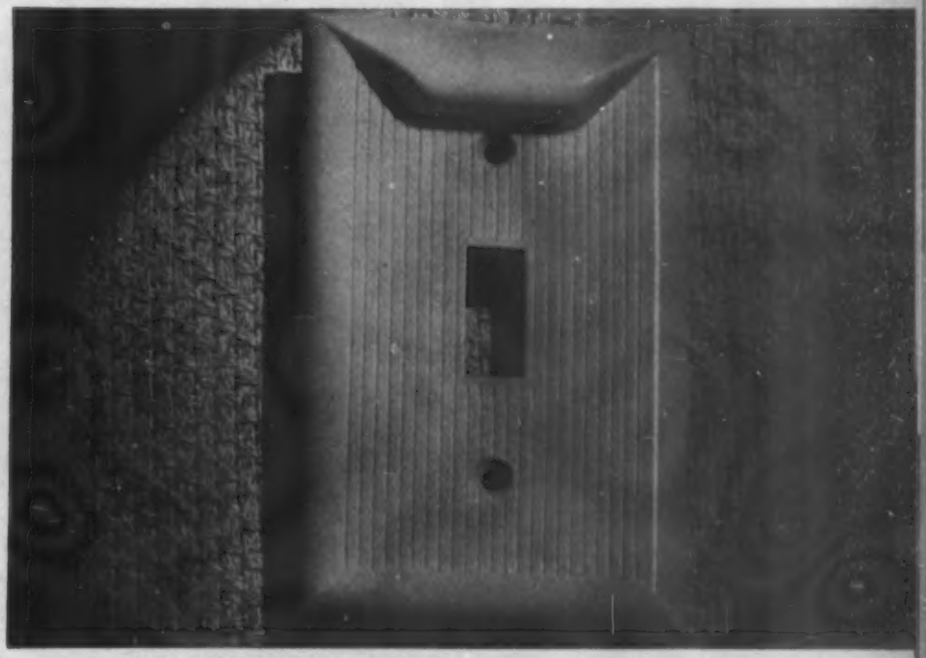
The non-metallic characteristics of this new cleaner suggest a variety of uses other than the scouring of pots and pans. These include the paring of rooty vegetables, cleaning tile, linoleum, and porcelain and enamelware. It also should prove effective as a pre-paint, rubdown abrasive for wood and metal surfaces, while still other uses would include the cleaning of garage and garden equipment, and dairy and farm utensils, industrial buffing, etc.



2

A new wall switch plate that should reduce home accidents and greatly contribute to the betterment of short tempers was recently marketed by Associated Projects Company of Columbus, Ohio.

Made of molded Plaskon, the new switch plate is equipped with a tiny lamp that glows when the lights it controls are out; goes off automatically when the lights are switched on.



The "LumiNite" switch plate spells an end to fumbling for switches in the dark, provides a subdued safety glow that prevents stumbling over objects that would otherwise be unseen, keeps walls free of smudges from hands groping for switches, shows when one has forgotten to turn off remote lights, and serves as a night-light in nursery or bedroom.

Another advantage of the LumiNite is that its rich, ivory plastic finish blends perfectly into any decorative scheme. The Plaskon material is a non-conductor of electricity; cannot rust, tarnish or corrode; and can be kept clean and bright with a damp cloth.

PHOTO, COURTESY SPAULDING FIBER CO., INC.

1—These pieces which are typical of the work that can be done on high-pressure laminates, include valves, gears, strips and shaped plates

Fabrication of high-pressure laminates

Part I of this article, which appeared in the December 1945 issue, dealt with the properties of laminates. Here, the fabricating procedures themselves are described in detail

SAWING, milling, routing, hobbing and engraving are all characterized by a tool which rotates and by the fact that the work moves parallel to the axis of the cutting tools. Also included in the group are band and circular sawing and milling operations. Despite the basic similarity of all these operations, there are wide differences in speeds, feeds, methods and equipment made necessary by the various properties of laminates as described in Part I.

Band and circular sawing—In the band and circular sawing operations, full advantage is taken of the extremely high speeds with which most grades of high-pressure laminates may be machined. Band saws are run at speeds up to 8000 surface ft. per min. and it is common to run circular saws at 13,000 ft. per minute. This is practical because circular saws and the larger size band saws may be sharpened on automatic filing or grinding machines at low cost and the time required to change saws does not exceed 1 to 2 minutes. Therefore, the fact that high-speed operations quickly dulls the tool so that circular saws, for example, must be ground after every 20 to 30 min. of actual production time, is of but slight significance.

Milling—Conventional milling operations may be performed on standard or horizontal metal milling machines although these units are only used when the operation cannot be performed on a higher speed machine. However, equipment of this type is indispensable for certain precision-type operations. Spindle speeds on the horizontal-type units are not very high and it is seldom that full advantage can be taken of the high cutting speeds possible with these laminates.

Routing—Routing is done on standard vertical spindle wood shapers. Here again, full advantage is taken of extremely high cutting speeds possible with this type of machine when used in conjunction with tungsten carbide tipped cutters. Routing in this fashion may be regarded as a high speed milling operation, and excellent work to close tolerances and high finish may be obtained quite economically. Both hand and power

feed are used, depending on type and volume of work.

While intricate forms may be routed on the edges of a straight length of laminate in one pass, the routing of forms on the outside or inside of irregularly shaped parts is best done using a master plate in conjunction with a disk which may be an integral part of the cutter, or attached to the table and, therefore, stationary. When operations of this nature can be performed on a vertical spindle wood shaper this tool should be used since it is by far the most economical.

Hobbing—Hobbing is done on standard metal hobbing machines with ground or cut hobs of high-speed steel. Due to the relatively low spindle speeds of these machines, full advantage cannot be taken of the high cutting speeds. However, this is not a serious drawback since even if higher speeds were available, they would probably not be used since tools dull faster as the speed of operation increases and hobs are expensive and difficult to sharpen. The most economical set-up is one in which the greatest number of pulls are machined before the tool must be reground even if this means some sacrifice of speed. Speeds about the same as for brass are recommended.

Engraving—Engraving is performed on the same machines that are used for metal; and separations are exactly the same. These machines run at very high spindle speeds and no modification is necessary for use on high-pressure laminates.

The general rules for all these operations when performed on high-pressure laminates are few and simple to remember. Where set-ups are simple and rapid, and sharpening operations automatic, as in the case of sawing, advantage should be taken of the highest possible speeds. The possibilities of the circular saw and vertical spindle shaper for many operations usually thought of in connection with standard milling machines should be investigated. Tungsten carbide tools should be used, with allowance for plenty of clearance and with zero or negative rake in milling, routing and engraving operations. All tools must be kept sharp and it will be found that in general more frequent grindings will be necessary than for similar operations on metals.

Lathe and screw machine operations

This group includes operations performed on machines where the work turns—on engine lathes, turret lathes, hand screw machines, single and multi-spindle automatic screw machines. For use on high-pressure laminates, such machines are identical in design with those used for the same operations in metal. However, due to the light weight of the material and its low shear strength, the equipment can be of lighter construction and can be run at much greater speeds than they can when used for the machining of the same size metallic parts. Speeds range from 4000 linear ft. per min. for some turning operations down to speeds which are approximately the same as those used for the turning, the cut-off and the reusing of brass on automatic screw machines.

Carbide-tipped tools should be used in every operation where volume justifies the expense and where the design of the tool makes carbide tips practical. Because of the resilience of the high pressure laminates greater clearance must be ground on all single point tools used for boring and turning. A range of 10 to 15° clearance will be found to be about right except on boring tools employed for the smallest holes where the clearance may have to be increased somewhat. The top rake will vary from zero for single point tools to approximately 10° negative rake for the cut-off and the form tools.

It will be found that extremely fine feed and the highest practical speed is best for forming tools of the flat or circular type. Feeds from 0.0005 to 0.001 in. are usual, as a general rule, and the forming tool should not have a width which measures more than 75 percent of the diameter of the work being machined.

It must be remembered that high-pressure laminates are not as rigid or as heavy as metals. Cut-off tools much narrower than those used for metals can be used with a very real saving in stock. The effect of heat when drilling deep holes on automatic screw machines can be minimized by withdrawing the drill once or twice during the cycle to clear the clips. Provision can be made on the cam for these withdrawals.

Tapping and threading

In threading, either internally or externally, the resilience of high-pressure laminates necessitates close attention to rake on taps and dies or on single point tools. The effect of positive rake is to cause the top, die or single-point chaser to dig in and crowd its lead. The result is a rough looking thread. More serious is the fact that the thread, being cut, may be weakened. Threading tools should be ground so that they have a negative rake up to about 10° depending upon the size

2—By changing the head, different sized holes can be drilled in laminated sheet by this drill press set-up

PHOTO, COURTESY OF WESTINGHOUSE ELEC. CORP.

of the thread, the pitch and degree of finish required. Where possible, a solid tap should be purchased a few thousandths oversize to compensate for the resilience of material. This is not a must but, for some jobs, it may be found desirable.

Speeds up to 200 ft. per min. may be regarded as a conservative guide on most jobs. This speed may have to be reduced on jobs of coarse pitch and may be exceeded on some grades of materials. All standard tapping and threading devices and methods, such as tapping heads in drill presses, collapsible taps, self-opening dies, milling and single hand multi-point chasing, may be employed.

For self-opening die heads, tapped-type chasers are recommended rather than the milled type. Due to the resilience of the material, tapped holes should be made from 0.003 to 0.006 in. larger than in brass or steel. It is well to remember that the drill will produce holes 0.001 to 0.003 in. smaller than its normal size.

Consequently, the grinding may have to be done slightly off center unless a standard size drill a few thousandths larger is available.

Drill press operations

This group includes operations where the tool turns but where there is no motion of the axis of the tools relative to the work. Examples are drilling, counterboring, tapping, countersinking, fly cutting, trepanning and reaming.

The resilience and heat insulation qualities of the high-pressure laminates are very noticeable in drill press operations. Heat produced by the cutting and rubbing action of drills, countersinks and like tools is dissipated very slowly. It is, therefore, quite localized and reaches a high temperature in the small area around the hole. The expansion of the stock due to heat results in a slight closing in of the hole around the drill.

This action and the natural resilience of the material leave a hole somewhat smaller in size than the drill. Dull drills seriously aggravate this condition and may cause lifting of the top layers of the stock around the hole when the drill is withdrawn.

For speed of operations, the usual recommendation is to run drill presses at the highest possible speed without burning the stock. The rate of revaluation will vary considerably with the depth of the hole. As with metals, small hole drilling in high-pressure laminates is seldom done at efficient speeds because of the difficulty of reaching spindle speeds which are high enough. When it is remembered that 10,000 r.p.m. are required to give a $^1/_8$-in. diameter drill a cutting speed of 300 ft. per min., it is evident that drilling operations on these laminates for small diameter holes are seldom performed at much more than half the recommended speed, an exception is the shop equipped with highest speed-sensitive drill presses.

While any and all high speed steel twist drills of standard design may be used, they are not recommended for production purposes. Drills specially designed for high-pressure laminates are stocked as standard items by all drill manufacturers. The flutes are wider than the standard type, are more nearly parallel with the axis of the drill and are polished. These modifications of design permit cooler and cleaner drilling with much easier chip removal. The angle of the flutes results in less hook or positive rake on the

3—Boring of the inside diameter of large high-pressure laminated tubing is done at high speeds. 4—Intricate contours, like those of a cam, can be cut from a laminated disk with great precision by a band saw

PHOTO, COURTESY WESTINGHOUSE ELEC. CORP. 3

PHOTO, COURTESY SYNTHANE CORP 4

cutting edges than is characteristic of standard type drills. For many jobs these drills can be used as purchased. But for some sizes of holes and for some grades of materials, it is advisable to remove all rake by grinding the cutting edges as is done for brass. Whatever type drills are used they must be kept sharp and should be ground with liberal clearance.

While reaming may be done, it is not recommended where other methods of sizing can be employed. Due to the resilience of these laminates, it is difficult to get enough holes from reamers of the solid type to justify the cost. Where reaming is necessary, reamers of the expansion type equipped with tungsten carbide blades are recommended.

Because of the low shearing strength of high-pressure laminates, efficient boring to close tolerances may be accomplished on the drill press at extremely high speed and for large diameters. Boring bars equipped with tungsten carbide tips give excellent results. Tungsten carbide tips should also be used for countersinks, counterbores and flycutting or trepanning tools. Flycutting is recommended where hole sizes are large enough since it is much more economical to sweep out a large hole by flycutting than reduce the whole mass to chips. Even light drill presses may be used economically for boring and flycutting.

Shearing, broaching, punching operations

In this group of related operations are included shearing, broaching, and punch press operations such as piercing, blanking and shaving. With the exception of broaching, all these operations are performed most efficiently on most thicknesses and grades of laminates by uniformly heating the stock. Tables exist which give the recommended heat range for each grade of stock. In general, it may be said that the heating temperatures are in the range of 200 to 280° F. Ovens heated by steam, electricity, gas, or banks of infrared lamps have all been used with success. The choice is determined on the basis of cost, convenience, ease of installation and upon the amount of heating to be done.

Machines used for this group of operations are all of the standard metal working types. Shears are the conventional metal squaring shears of the guillotine type. Punch presses are exactly the same as for metal except that for the same dimensions and thicknesses considerably lighter presses can be used with laminates than with metal. The machines may be equipped with automatic or semi-automatic feeds utilizing hoppers, rotary table, cam or friction roller methods.

Broaching machines are of the standard horizontal or vertical types. This operation may also be done on the punch press if a short broach can be utilized. Broaching technique for high-pressure laminates is exactly the same as for metals. However, due to the laminated structure of the material, it is advisable when broaching across the laminations to back up the material with a mild steel or brass plate that is a close feed on the sizing teeth of the broach. This precaution will prevent fraying or chipping of the edges. When broaching

PHOTO, COURTESY WESTINGHOUSE ELECTRIC CORP.

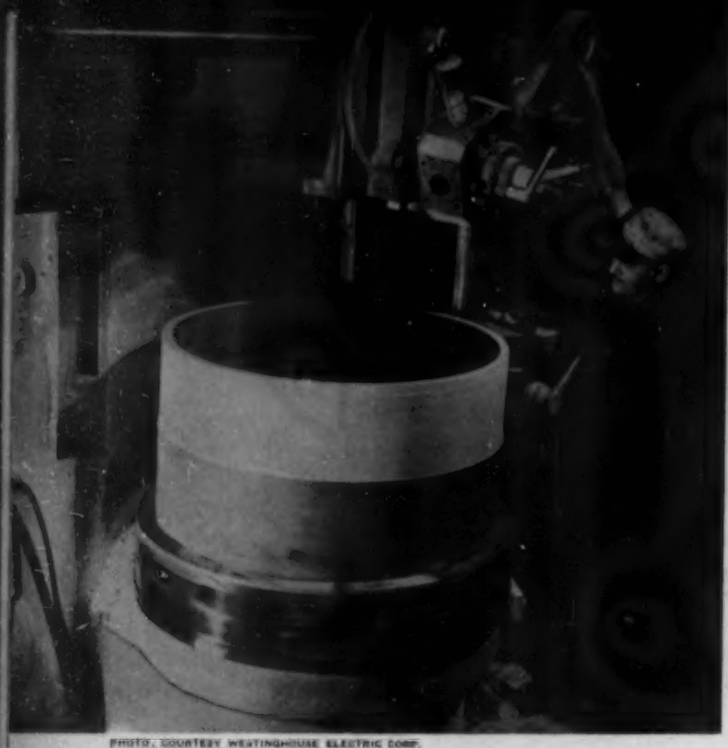
5—Standard or horizontal metal milling machines are used for conventional milling. Here a high-speed machine is used in fabricating a large laminated bearing

parallel to the laminations a fixture applying pressure at right angles to the laminations should be used.

The broaches themselves are exactly the same as those used for brass, but with an approximate 4° cutting clearance. A cut of 0.001 to 0.005 in. per tooth is about right with the pitch of the teeth ranging from one fourth to three fourths in., depending upon thickness of materials and the type of work that is being done.

Dies for blanking and piercing these materials should be made with a minimum clearance between the punch and the die. For best results in both appearance and dimensions, stripper plates of the compression type should be used, provided with a sufficient number of strong springs and adjusted to give very high pressures during the actual piercing and blanking period of the cycle. Much of the trouble experienced with these materials in punching operations, particularly in relation to cracked or ragged edges and surfaces, is due to the absence of compression-type stripper plates or to insufficient pressure at the right point in the cycle. As with all tools used to fabricate high-pressure laminates the dies must be kept sharp.

For close-tolerance work which is punched cold, allowance must be made in stock with a thickness of one sixteenth to one eighth in. for the punch to produce a hole 0.005 to 0.009 in. smaller than its over-all dimensions. The blanks will be 0.005 to 0.009 in. larger than the hole in the die in the same thickness range. This is due to the resilience of the material. When stock is heated, additional allowance must be made for shrinkage in cooling. This applies when holes are large and when critical dimensions must be maintained to close tolerances. The allowance will vary from about 0.001 in. per in. for stock heated to 200° F., to about 0.002 in. per in.



PHOTO, COURTESY WESTINGHOUSE ELECTRIC CORP.

6—A vertical boring mill provides a good means of cutting large-sized laminations to close tolerances

for stock heated to 220° F., with a proportional allowance for temperatures higher than these. These recommendations are for laminated phenolic and must be modified somewhat for other high-pressure laminates.

Punch press procedure with these materials is similar enough to that used for metals so the experienced die maker and press room foreman should have no serious trouble if stock is properly heated and presented to the die at the correct temperature. Too often, stock which has been properly heated cools off before it is actually punched or pierced. This is usually due to the bad placement of the oven with respect to the operator and the punch press.

It is impossible to give enough information so that the die maker who has had no experience with these materials will be entirely successful with his first die. It must be accepted as a fact that experience with these materials is necessary before complicated dies requiring no modification are turned out regularly.

Shaving is the punch press operation which deserves special mention because of the economy with which it turns out intricate shapes with excellent edges. The die is extremely simple. The shape is worked out in the die block and the outside edge is given a bevel of 45°. Since there is no clearance on the inside the die can be sharpened without changing the form or dimensions. The punch is simply a piece of brass or mild steel which does not enter the die. The ram is adjusted so that at the end of the stroke the soft punch barely touches the die, forcing the piece through the shaving die.

This method is used when extremely smooth edges are required on parts which are in the range of practical punching thicknesses or when irregular shaped blanks are required which are too thick to be punched. The stock in the form of rough blank parts or in the form of circular-sawed or band-sawed blocks are passed through one or more of these shaving operations which remove one sixteenth to one eighth in. of stock.

With this method most grades of stock may be shaved cold as long as they do not exceed $^1/_8$ in. in thickness. Above this, and up to a thickness of about $^3/_4$ in., heating of the stack to 250° F. is recommended. Work of exceptionally fine finish and close accuracy on irregularly shaped parts may be turned out with excellent economy by shaving. For certain grades of laminated phenolics below $^1/_8$ in. in thickness, combination punching, blanking and shaving dies which perform all operations at one stroke can be used.

Abrasive operations

Machines used for grinding and polishing high-pressure laminates are identical with those used for similar operations on metal. Sanding machines of the largest sizes are the same as those used for sanding plywood and other large sheets in the woodworking industry. Bench and disk sanders common to the average metal shop are also employed for various fabricating operations on laminates.

High-pressure laminates may be ground with great economy. Centerless grinding is employed as a standard sizing operation for tubes and rods, and for the production of finished parts to precision tolerances. Form grinding may be done on surfaces or edges of straight strips, or it may be used to produce balls or parts with spherical and other compound curved surfaces. Surface grinding is a common method for producing parts to close tolerances. Either double or single wheel machines can be used.

The structure and properties of laminates probably affect grinding less than any other operation. Their low shearing strength is of advantage, however, because of its influence on the amount of stock removed per unit of power consumed and because it results in long wheel life between dressing operations. The volume of grinding that was done on these materials increased very sharply during the war and should continue to increase because of the economy with which many types of work can be produced. These laminates may be polished by standard methods on standard machines with standard polishing wheels and rouges. As with all plastics, the property of low heat transmission must be taken into account so that serious localization of heat and burning does not occur.

Marking operations

A number of methods may be used to mark high-pressure laminates with decorations, characters, numerals, printed instructions, etc. Engraving, a very common means of marking, is actually a high-speed milling operation and was discussed earlier in this article. Another common method for volume production is hot roll leaf stamping which is done by pressing heated steel stamps into the surface of the laminate through a thin sheet of pigmented roll leaf, available in

various colors for contrast. Special machines may be purchased for this operation, some models being designed for hand operation for low-volume production. Standard printing processes and machines are also available for printing with various colored inks. This type of work is later given a protective coating of varnish or lacquer, baked on to insure permanence.

Special forming operations

The forming of certain grades of finished laminated phenolic sheet has become a standard fabricating process within the past two years. This new technique appears to have great potentialities for extending the number of applications of these materials. Blanks of special postforming material are heated uniformly to a temperature in the neighborhood of 370° F. and quickly placed in a mold to be formed to the required shape under comparatively low pressures. Parts are permitted to remain in the mold for a brief period to cool below plastic state induced by the high temperature.

Heating mediums include hot presses and hot platens, liquids of high boiling points and metals of low melting points, ovens with mechanical convection, infrared lamps and dielectric heating. Molds for small quantity production may be made of wood, laminated phenolic sheet, casting resin or gypsum compound. For large volume production or where close accuracy is required, the molds should be made of steel, Kirksite or other special metals. For high speed operation, provision should be made for cooling the mold either by means of internal water coils or air jets applied to the surface of the mold when opened.

While parts have been made by this process from phenolic paper base laminates, it is suggested that designs be worked out in fabric base laminates wherever possible since these grades have greater stretch and consequently better forming characteristics. The potential users of this process should work with the engineering department of manufacturers of laminated phenolics in developing proposed designs.

Like any other process, the postforming of these materials has its limitations. However, within the fields of applications for which it has been found adapted, it has solved problems of cost and function much more efficiently than other methods. It is expected that the number of practical applications of postformed laminated phenolic parts will increase very rapidly as familiarity with the methods grows.

Another common method of forming special shapes from the high-pressure laminates is a modification of the process used to form flat sheets. Shallow shapes, shapes with compound curvatures and strips of varying cross sections can be molded under the same pressures and heat as are used with sheets. The paper or fabric bases, impregnated with resin and partially cured, are built up to the required thicknesses. These piles are then formed under heat and pressure between plates or molds, machined to the required cross section or, with a number of impressions or cavities, machined in them.

After molding and curing, the impressions are trimmed from the sheet in a punch press. In the case of strips of various cross sections, surplus material is removed by the circular saw. This molding method is used for parts required in such volume as to justify the costs of the molds and where the desired cross section is too thin for powder molding.

Manufacturers of high-pressure laminates stress the fact that these materials are fabricated with ease. This is quite true, but it is also true and not so well understood that for maximum economy, departments must be set up which will specialize in such work. This involves the selection of the most suitable combination of machines and their proper arrangement. An adequate dust removal system must be designed and installed. Facilities should exist for brazing, grinding and lapping tungsten carbide tools, and for automatic band and circular saw grinding. Only with such a well-equipped and thoroughly planned fabricating unit, operated by experienced personnel, can the most economical results be achieved in all operations.

The economical fabricating department

Designers who are interested in the possibilities of these materials should accept with caution any estimate of the cost of fabricating them if such an estimate is based on ordinary shop practice—particularly if it is made by men whose experience has been limited to metals. As we pointed out in the beginning, not only can differences in the price per pound between high-pressure laminates and other materials be substantially reduced by efficient fabrication but, in many cases, they may be completely recovered. It is even possible to effect savings through a proper fabrication set-up.

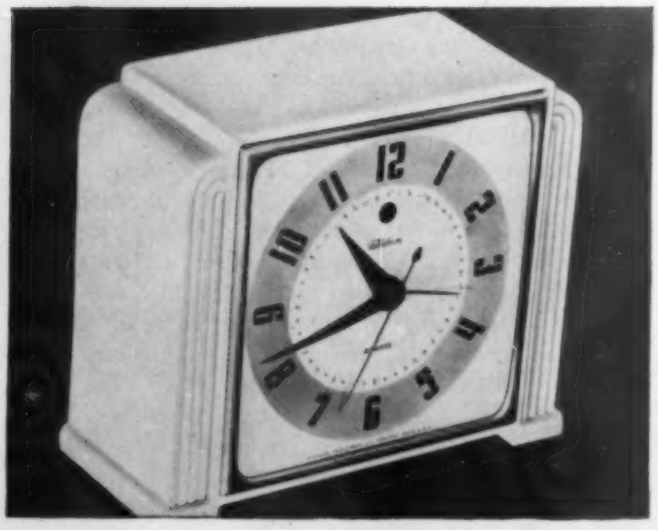
It is doubtful whether the average user, fabricating only small quantities of these materials, can hope to achieve such saving. A careful investigation of fabricating costs would, in many cases, result in a special unit being set up or in the job being turned over to specialists in the fabrication of high-pressure laminates.

7—High-pressure laminates lend themselves to punching and shaving operations. Here a strip of laminated sheet is being fed through a punching machine

PHOTO, COURTESY SYNTHANE CORP.

A NEW Beetle Plastic

The ivory BEETLE plastic case of this Telechron electric alarm clock, product of the Warren Telechron Company, has the charm of color, the pleasantness of texture, the lastingly beautiful finish to create and satisfy customers. Smart, quality appearance in BEETLE plastic housings can be achieved on a low cost, volume production basis.



Housing Material

The new BEETLE* plastic molding compound has been developed especially for housings. The most important characteristics of this material are improved dimensional stability, and reduced aging shrinkage. Molding qualities are excellent.

This improvement in dimensional stability provides safeguards against stresses which may affect internal moving parts such as the tiny motor in this electric razor—and yet this improved BEETLE plastic is handsome as well as practical. It has all the basic requirements you need for a powerful sales appeal—color—customer satisfaction—product efficiency—and economical production.

The new BEETLE plastic will impart lasting usefulness and beauty into housings that are well engineered for production with urea compounds.

Perhaps you have a product design or housing problem that can be solved with this improved BEETLE plastic. Our engineering staff or any experienced molder will be happy to assist you.

*Reg. U. S. Pat. Off.

AMERICAN CYANAMID COMPANY • PLASTICS DIVISION
32 ROCKEFELLER PLAZA • NEW YORK 20, N. Y.

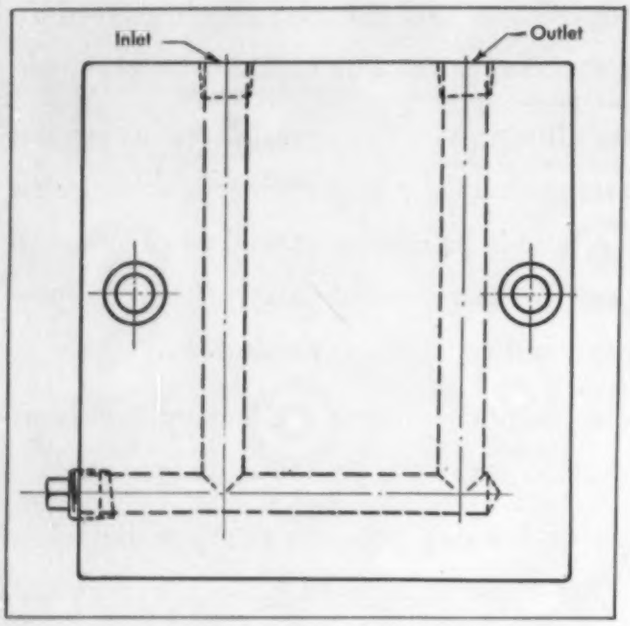
Cyanamid Plastics *Beetle · Melmac Melurac · Laminac · Urac*

For distinctive, efficient product housings, such as this radio cabinet molded for the Emerson Radio and Phonograph Corporation, BEETLE plastic offers a combination of unmatched advantages. A broad range of colors can be utilized in design. BEETLE plastic is naturally insulating, dimensionally stable, can be quickly, accurately molded.

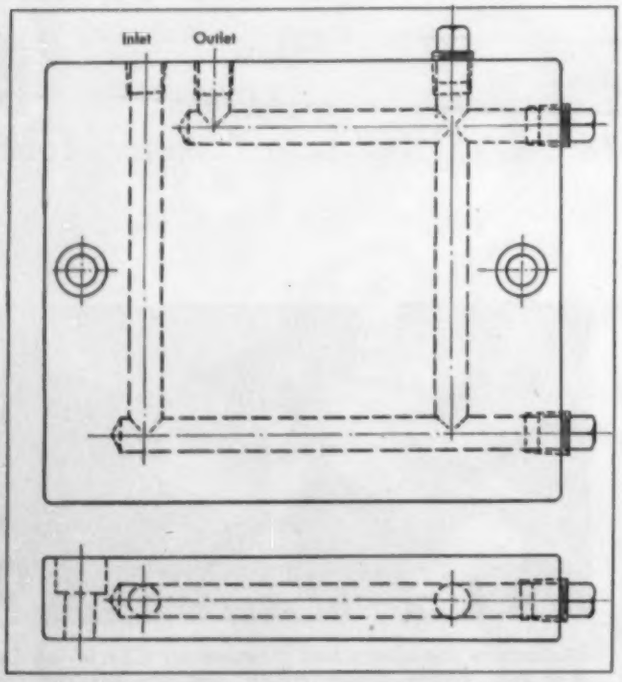
Distinctive containers and closures for Charles of the Ritz cake rouge, cream rouge, and eye shadow are molded of BEETLE plastic. Colorful BEETLE plastic is an ideal packaging material for cosmetics, beauty preparations, and other items that depend on eye appeal for initial as well as repeat sales. It is also chemically inert.

Steam tables for molding dies

by JOHN H. BURKHAM*



1—The simplest form of steam table has inlet and outlet steam ways, with a cross hole drilled to connect them



2—This steam table has extra holes bored to increase steam circulation. An end view of the table is likewise shown

ONE phase of molding die design which deserves special attention concerns steam tables or steam ways around the cavity inserts. A completed mold may be of first class design and faultless construction so far as the mechanical parts and mold cavities are concerned, yet be a sad failure if it does not have proper heating facilities.

There are two classes of steam tables: 1) the attached and 2) the detached.

1. The attached steam table is designed as an integral part of the mold assembly. Its various dimensions, steam ways, etc., are laid out to suit the one job. In many cases, the steam table becomes the chase for holding the die inserts.

2. The detached or utility steam table is for use on the press platens for portable or hand molds, or as a hot plate on the bench or table. When used in the molding press, a pair of these tables is made for the upper and lower platens. It is advisable to provide a series of tapped holes in the exposed face for cleats or slides. Then the hand molds may be attached to these slides if that is desired.

Steam tables may be made in four different types—drilled, copper brazed, welded and poured.

Drilled steam tables

The drilled type table consists of a single steel plate about $1^{3}/_{4}$ in. thick and of desired area, in which holes for steam ways have been drilled or bored. The smaller size is made very simply with inlet and outlet holes connected by a cross hole (Figs. 1 and 2). The larger size steam tables require several circulating holes so arranged that the steam is evenly distributed and completely circulated (Figs. 3 and 4). The bored holes should be $^{9}/_{16}$ in. in diameter for $^{3}/_{8}$-in. pipe thread, or $^{23}/_{32}$ in. in diameter if $^{1}/_{2}$-in. pipe thread is desired. If crowded for space, the holes may be smaller and counterbored to suit the pipe threads.

This type table is suitable for small jobs or for work demanding quick construction, especially where the mold does not require alternate heating and cooling. It is particularly suitable for use with injection molds.

Copper brazed steam tables

The copper brazed type steam table (Fig. 5), is somewhat more expensive than the drilled table but it is much more efficient. It is used for larger molded products where more heat is required, or where the mold must be heated and cooled alternately. The main body, about $1^{1}/_{2}$ in. thick, has the channels milled and

* National Cash Register Co.

the pipe connection holes tapped. The cover plate which is about $^5/_8$ in. thick is constructed so that it is about $^1/_8$ in. larger all around than the main body. This construction leaves a ledge which can hold the brazing copper. The two plates are faced on both sides and joined with enough screws so that they are held securely together while brazing.

In some cases it may be better to set in pieces or strips rather than mill the steam ways. Circular channels may be used in smaller jobs, because turning is usually simpler and less expensive than milling (Fig. 6).

When the plates and inserts are all prepared, the brazing copper is placed around all inside joints and the unit securely fastened together. Just before the assembled parts are placed in the brazing oven, strips of brazing copper are placed in the outside joints. Small pieces of copper should also be placed at screw heads and in open spaces at the screw points.

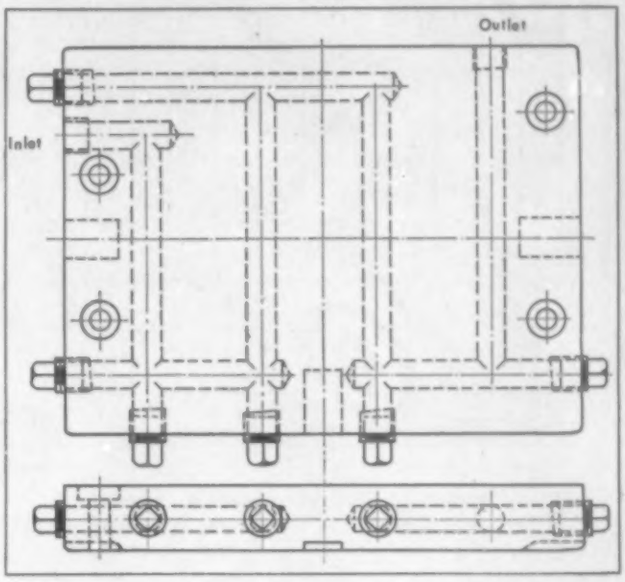
The copper wire around the outside ledge should be in short lengths of about 4 to 6 in. because of the way it expands under heat. Good copper brazing depends on clean close-fitting surfaces and on the proper amount of pure brazing copper.

After the brazed steam platen is slowly cooled, the pipe holes are retapped. A leak test is then applied before the necessary machining is completed.

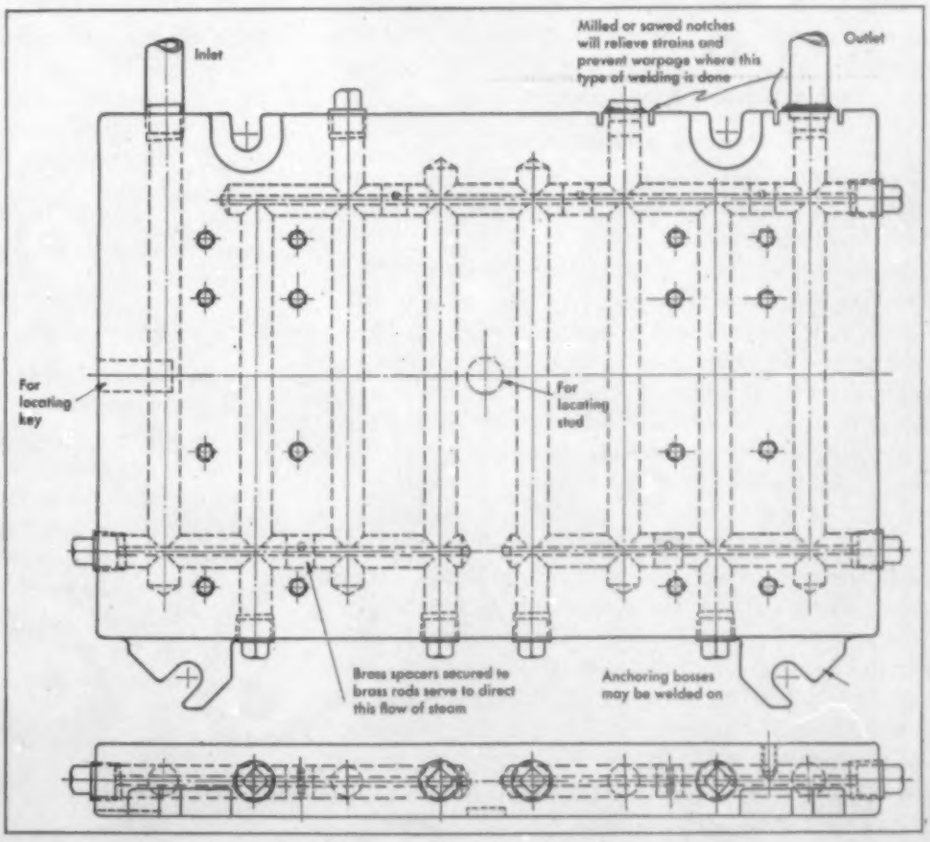
Arc-welded steam table

This type steam table is a very economical structure, specially when there is available the necessary flat stock and the facilities for torch cutting and welding. This arcwelded table can be made quickly, it is very efficient and it can be adapted to meet practically all mold requirements (Fig. 12).

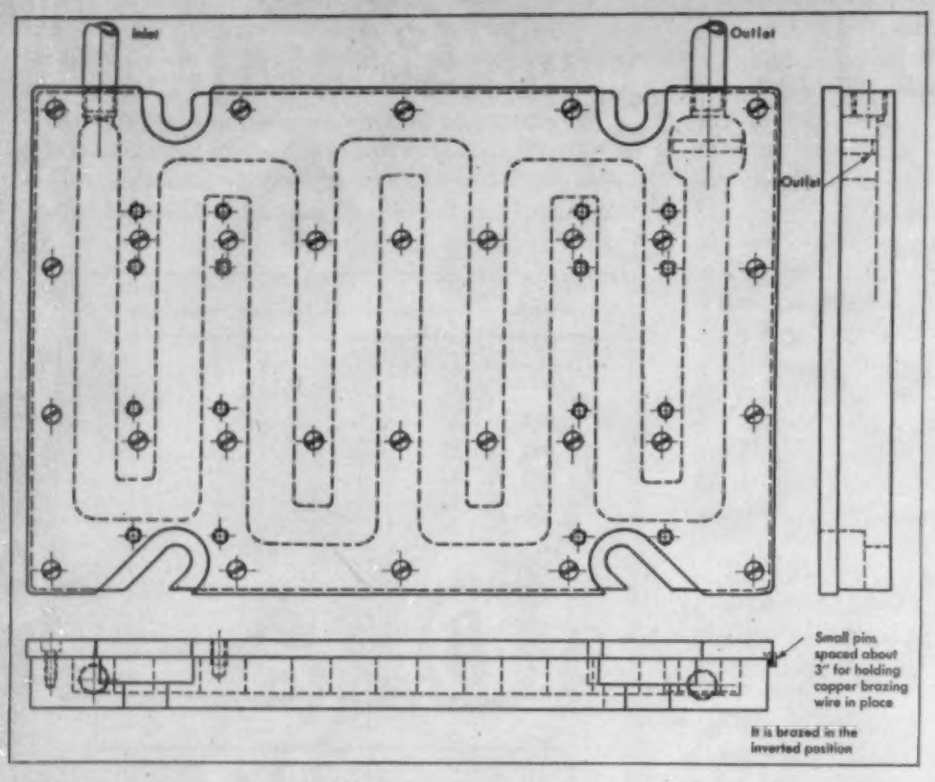
The plates and bars are roughed out and the necessary holes are bored or burned. The pipe connection holes are drilled and tapped, and the various parts are arc-welded together in proper order. The inside chan-



3—Large drilled tables are suitable for use in injection molds or molds not requiring alternate heating and cooling


Inlet
Milled or sawed notches will relieve strains and prevent warpage where this type of welding is done
Outlet
For locating key
For locating stud
Brass spacers secured to brass rods serve to direct this flow of steam
Anchoring bosses may be welded on

4—Holes should be bored $^9/_{16}$ in. in diameter if $^1/_2$ in. thick pipe thread is desired; $^{33}/_{32}$ in. diameter for $^3/_4$ in. thread; or else may be bored smaller and counterbored to suit the pipe threads


Inlet
Outlet
Outlet
Small pins spaced about 3" for holding copper brazing wire in place
It is brazed in the inverted position

5—The copper brazed steam table has milled channels and the pipe connection holes tapped. It is used where greater heat is required or where mold is heated and then cooled

nels may be machined in the solid plate or they may be formed by setting steel bars in place and tacking them with weld spots. All leak-proof joints should be welded on the outside so that any leaks which develop may be easily repaired.

After the welding is finished, the assembly should be annealed or normalized to relieve all strains. The pipe connection holes are retapped and an internal pressure test is applied before the machining is done.

Poured steam table

For a plain steam table for use on the bench or in the press for portable molds, there is none more simple than the poured job (Fig. 7).

An open tray about $1^{3}/_{8}$ in. deep is constructed by attaching steel bars along the four sides of a piece of $^{3}/_{8}$- or $^{1}/_{2}$-in. boiler steel, or machine steel, of the desired area. The bars may be tack welded or fastened in place by small screws. The front and back strips should be about $^{3}/_{8}$ in. thick—the back one drilled for a space of $^{29}/_{32}$ in. at two correctly located places to allow passage for the inlet and outlet pipes. The side strips are wide enough to carry the anchoring screw holes.

A set of pipe coils is made up as shown in Fig. 7 by using $^{1}/_{2}$-in. standard pipe and return bends. When placed inside the tray, the coils should be held in place by a few small pins or screws. This prevents floating. The holes around the inlet and outlet pipes are sealed with fire clay. The set-up of the coils, plate and side strips is heated to about 650° F. and poured heaping full of molten metal. Babbit will do, or any kind of metal which melts at low temperature. Kirksite[1] and Zamak[2] are both very satisfactory. They melt at a little over 700° F., are sufficiently hard and are good heat conductors. After this steam table is cooled, the top and bottom are machined until they are parallel and the necessary holes drilled. The steam table is then ready for use. The steel side is used next to the mold. Of course, the coils must be so arranged that they will not be penetrated by drilled holes.

The type of steam table to be used on a job depends on a number of factors. The time limit—that is, the speed with which the job must be done—may necessitate a table that can be made quickly. For the low usage job, the cheapest steam table will be selected. Large quantity production which shows promise of repeat orders or long usage, will justify the most efficient type of table.

Choosing the correct steam table

Sometimes the very nature of the mold construction will make necessary the use of a particular type of steam table or steam ways. Again, the kind of constructing equipment on hand or the available material may be the deciding factor.

Compression molds for thermoplastic materials must be heated and cooled alternately. Therefore they should have the most efficient steam table so that the cycle can be shortened. With molds for thermosetting materials, the more simple type of table may be used since the dies are operated at constant temperature.

In some cases the lower steam table may be of a simple bored type while the upper is constructed for greater efficiency. Such construction will be particu-

[1] National Lead Co.
[2] New Jersey Zinc Corp.

larly important where there is a deep material chamber in the lower part of the mold and a long projecting force part attached above. Under such conditions it is sometimes advisable to bore a hole in the top end of the force, as deep as practical, and fit into it a piece of copper, machining it flush at the top where it contacts the steam table. The copper conducts the heat to the end of the force.

A very effective way of heating an extra large, or extra deep force is with a syphon (Fig. 8). Here the water, or condensate, is completely removed, allowing the steam to get at the part to be heated. This syphon is not difficult to construct and it is very efficient.

When it becomes necessary to heat a long core, or where only a single hole can be bored in the mold, such a construction as shown in Fig. 9 can be used. The special fitting and the inside pipe should be brass and all of the threads should be standard pipe size.

General rules

There are some general rules and precautions which might be helpful to any one designing steam tables.

It isn't good practice to make the steam ways too small. One of well-proportioned size will give a more even temperature; one of ample thickness will be less subject to warpage. On the other hand, steam tables should not be so large that they overhang the platens and allow the mold to spring apart. If they are made unreasonably thick, they will absorb too much heat and retard the cycle.

Heating efficiency depends largely on the amount of exposed area in the steam ways. In view of this fact, extra rapid change of temperature may be effected by turning grooves or fins around the inserts or stools in the steam table (Fig. 10).

Circulation should be complete with no dead pockets. Since water is a poor heat conductor, the outlet hole should be low enough to permit complete drainage.

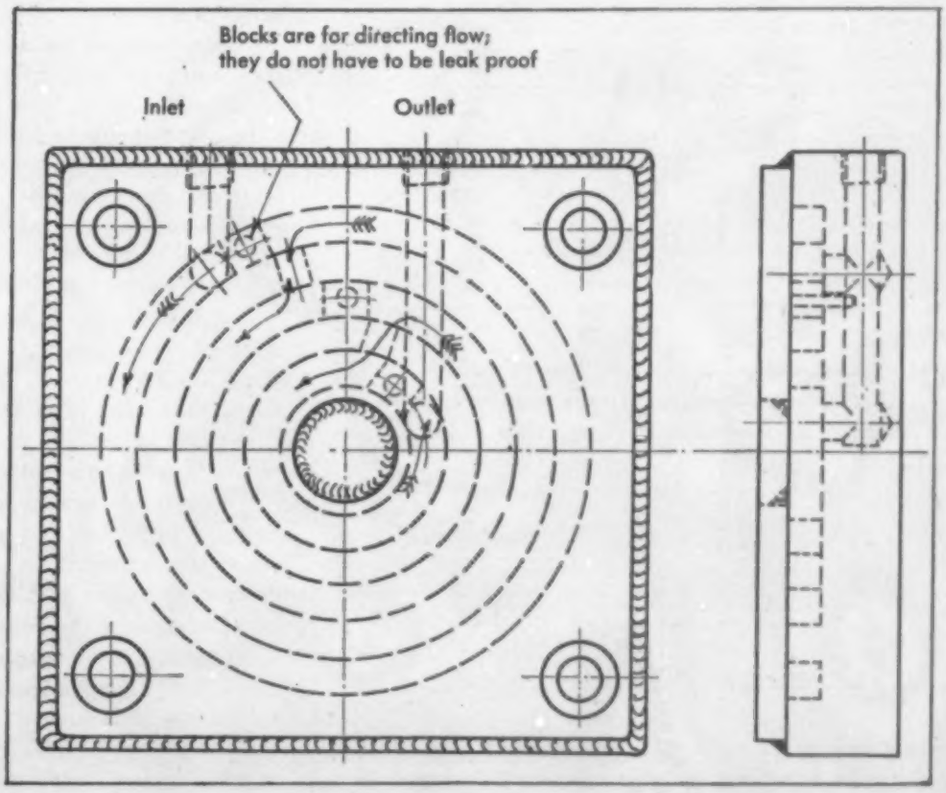
If a job demands that the steam table be heated quickly, the outlet orifice should be provided with a baffle plate to confine the outlet flow to a narrow slit at the bottom (Figs. 5 and 12). This arrangement will result in the water being completely forced out as the steam fills the chamber. Also, it will prevent the steam from escaping with the water.

The pipe connection holes should be plainly marked *inlet* and *outlet*. In some cases it may be necessary to designate which is the right side up or which is the upper or lower steam table.

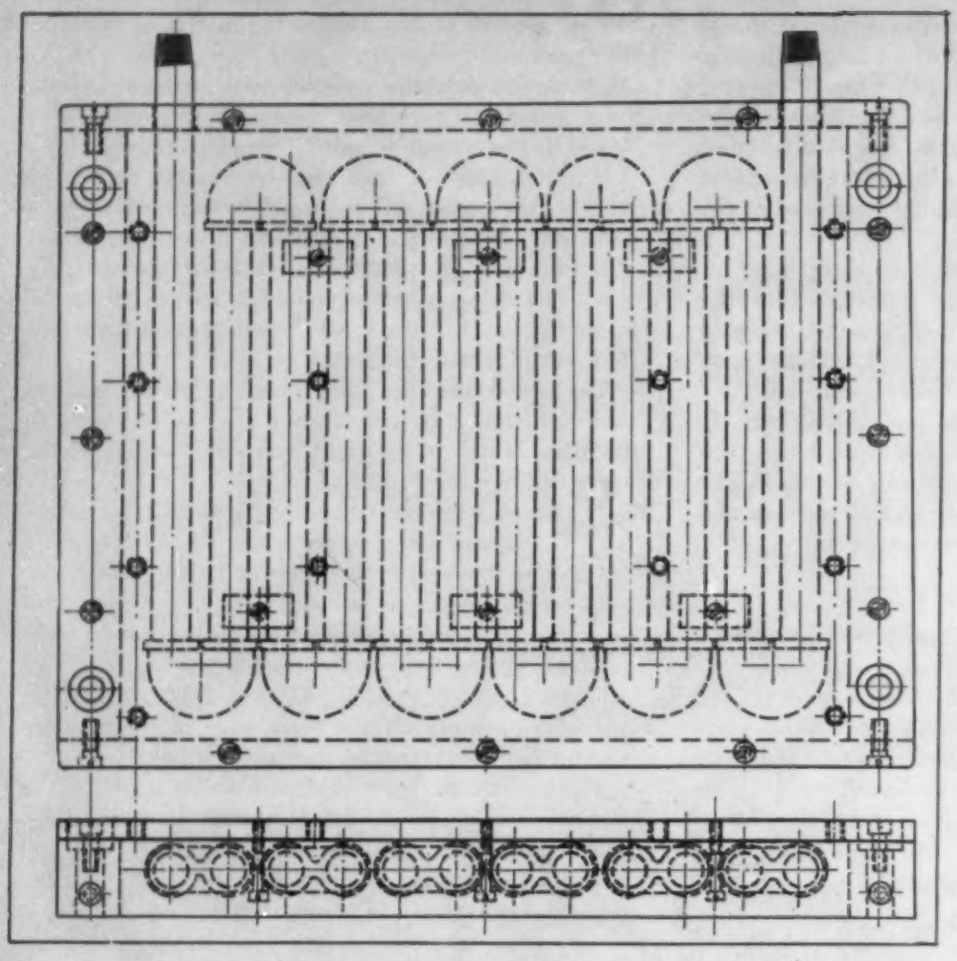
The steam ways must be arranged to clear all cavity pockets, ejector holes, screw holes, etc. If they are too close to the mold cavities uneven heating will result.

In copper brazed or welded steam tables, the total projected areas between the steam ways must be sufficient to support the required molding pressure. This should be figured at about 4000 or 5000 p.s.i. It is advisable to mark on the front edge of the mold or steam table the maximum pressure to be used.

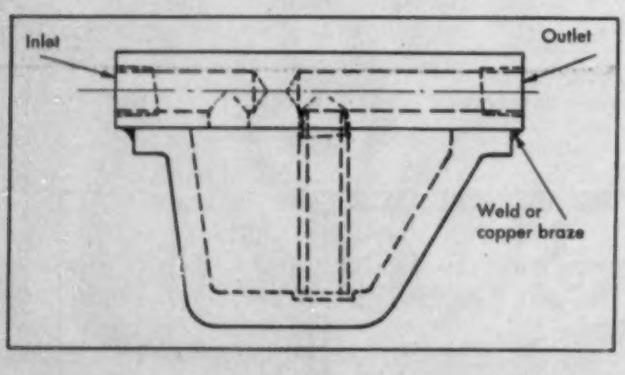
The plates and bars which are to be used for the construction of steam tables should be normalized before machining. This practice relieves strains and minimizes warpage, and is accomplished by heating the metal in an oven to about 1500° F. and holding it at this temperature for a few hours before permitting it to cool slowly. For welded steam tables the normalizing is done after assembling. For copper brazed or



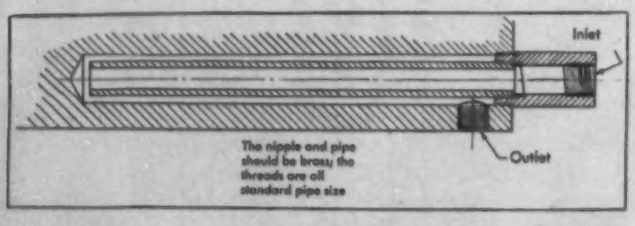
6—Circular channels may be used as steam ways, particularly for smaller jobs that do not justify intricate and expensive milling



7—The poured steam table provides simplest means of making intricate table. Briefly, the table is made by placing lead piping in a steel tray, pouring molten metal over it, which, after it cools, seals the piping in place. Top and bottom are then machined parallel



8—A syphon, which can be easily constructed, affords the most effective way of heating an extra deep or large force. By removing the condensate it allows steam to get to part



9—For heating a long core, a mold in which only a single hole can be bored, the above construction is recommended

poured steam tables, the normalizing should be done before assembling.

Copper brazed as well as welded steam tables should always undergo a pressure test before they are machined.

In bored steam tables all pipe plugs for stopping off the holes should be of bronze. Bronze makes a good joint and does not rust. When possible, the grain of steel should run the same direction in the main plates of a steam table. This is conducive to equal expansion when the plates are heated, thereby reducing warpage.

If it is necessary to attach the pipe connections and stop plugs by welding, a very good way to reduce strains and warpage, is to cut notches at both sides of the welded spots (Fig. 4).

Do not put steam ways in cast iron plates. It is almost sure to be a leaky job.

All exposed corners and edges should be slightly rounded to protect the workman. Corners and edges which contact the press platens should also be rounded so that the plate will not make a nick should it be knocked against the press.

At some convenient place in the front of the mold or steam table, there should be a $^1/_8$-in. drilled hole for a pyrometer attachment or thermocouple well. This hole should be positioned as close to the cavity insert as possible, but should not penetrate the steam ways.

Adapters

All steam tables or molding die assemblies should be mounted on adapters for convenience in handling and anchoring. Where an ejector mechanism is required the adapter combines with the grid to support the steam table.

Ordinarily the adapter should be insulated to prevent dissipation of heat. Probably the best method of insulation is to machine a series of grooves in the contact face of the adapter (Fig. 11), leaving enough area in the lands to support the molding pressure, figured at about 5000 p.s.i.

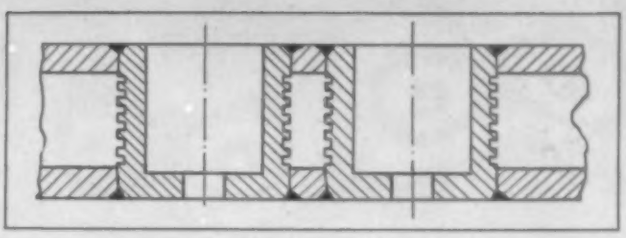
Guide pins

In a complete molding die assembly it is not good practice to put the guide pins and bushings in the steam tables because a slight variation in heating will cause binding. It is better to attach them to the adapters, which are not subjected to expansion and contraction. If the bushing is in the lower section, there should be an opening at the bottom to permit dirt to escape. If this is not possible, it is advisable to place the bushing above.

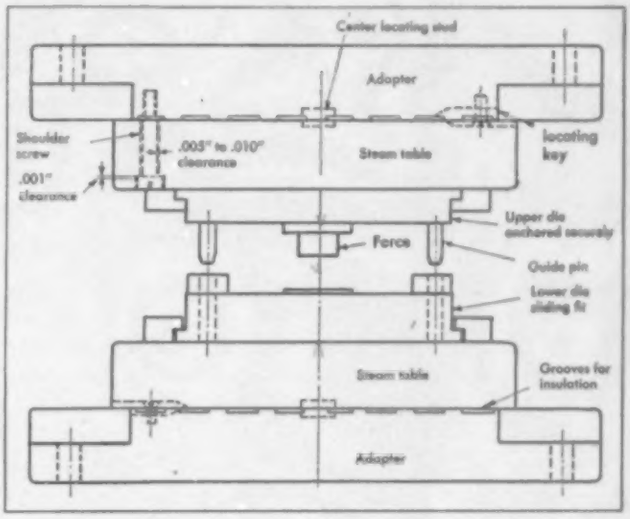
Whether the adapters are of welded or cast construction, suitable bosses can be provided to support the guide pins and bushings.

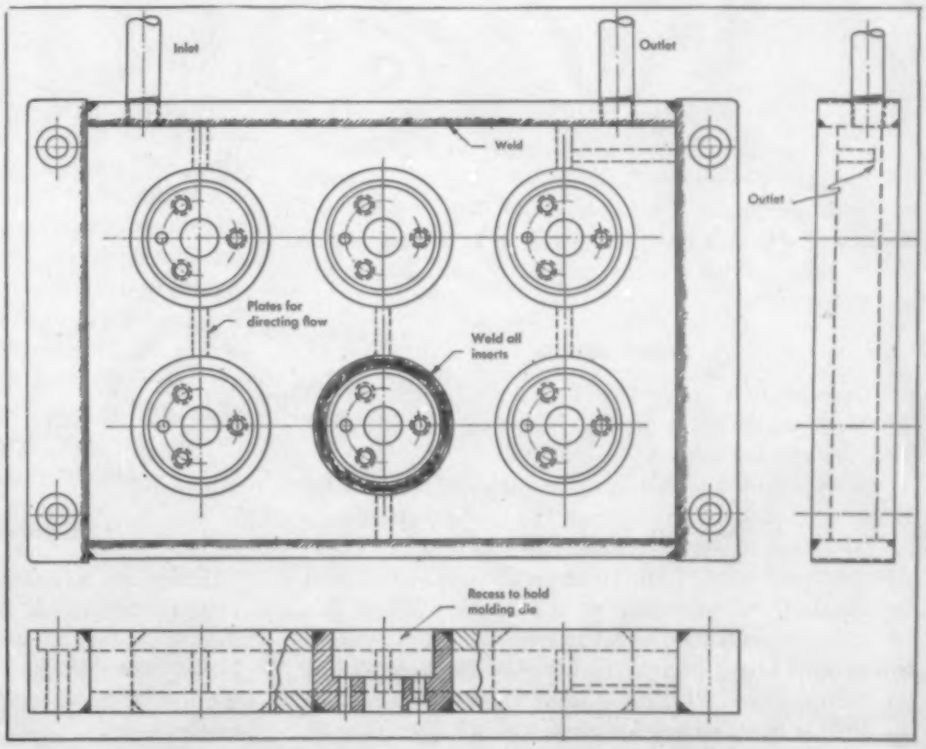
Dowel pin substitutes

Dowel pins should not be used to locate the steam tables on to the adapter because of shearing action due to expansion. (The toolmaker may put them in temporarily but remove them when they have served his purpose.) A better method is to place a shallow stud in the center of the table and another stud or key to

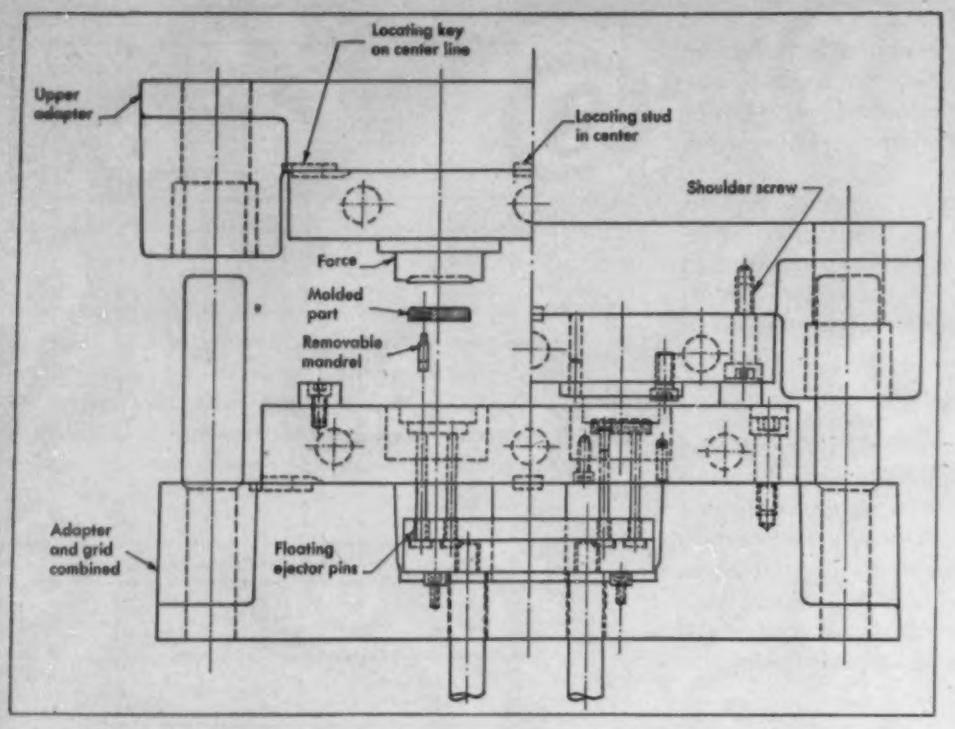


10—Fins or turning grooves around the inserts or stools of a steam table enlarge the exposed area and therefore increase the heating efficiency of steam ways. 11—Below, a mold attached to a utility steam table. The adapter, on which steam table is mounted for convenience in handling, is insulated by grooves in contact face of adapter





12—The arc-welded table can be adapted to practically any needs. This one has recesses for holding die inserts securely in place



13—Good design dictates that guide pins and bushings are not attached to the table but to adapters which will not expand and will not contract with heat

engage in a slot near the edge (Fig. 4). Another very good method is to use three keys at the edges on the center lines and 90° apart (Fig. 3). Either method will direct all expansion and contraction radially from the center and, at the same time, prevent any twisting movement.

It may be well to mention here that when ejector pins pass through the steam table and are actuated by an ejector plate in the grid below, they should be made to fit loose in the ejector plate. This set-up allows them to float with the expanding movement of the steam table (Fig. 13).

Anchoring of steam table

Do not fasten the steam table tightly to the adapter but use shoulder screws (Fig. 11) allowing about 0.001 in. clearance under the heads and 0.010 to 0.015 in. clearance on the diameters, depending on the size of the steam table. This practice will allow for free expanding movement.

Hand molds

It is sometimes practical to fasten the hand molds to the steam tables in the press so that they will be pulled with the opening stroke.

The upper mold section may be anchored securely by means of cleats or toe clamps; the lower section may be approximately located in slide ways (Fig. 11). Then, after the die is opened, the lower section can be removed for cleaning and reloading on the bench. When this set-up is used, it is good safety practice to fasten a microswitch on the back edge of the lower steam table so that the press cannot be operated until the movable part of the mold is in its proper location.

The drawings

It is important to have an accurate record of the steam table interior so that future changes or improvements can be made without danger of leaks being started.

It is important to have all dimensions properly and consistently placed so that the drawing can be readily interpreted at a later date.

Some simple rules should be followed, such as dimensioning from center lines, tying up with certain finished edge, transferring of holes from hardened parts to soft parts, etc.

By careful planning, a considerable number of parts may be standardized, such as shoulder screws, guide pins and bushings, locating studs or keys, toe clamps, toe bolts, etc. Also stock steel sizes may be used to advantage if the designer is alert and selects them with considerable care.

The writer has always considered it wise to consult freely with the toolmaker and other interested persons before finally releasing a set of drawings. Their suggestions and cooperation will be a great help in methods of construction and details. These specialists will often be able to offer valuable short-cut procedures which will save time and money.

A notebook for records

There are so many items of importance connected with the designing of molding dies and steam tables that a draftsman should keep records in a notebook, jotting down things he has learned by experience and contact with others, rather than depend solely on his own memory.

Tenite radio case molded by Worcester Moulded Plastics Co. for Emerson Radio and Phonograph Corp.

Following a well-established tradition, lightweight Tenite encases the first of the postwar pocket radios. Tenite has been used on virtually every make of radio — for cases such as this one, for grilles, dials, and knobs, where features of beauty and durability are important.

Tenite is practically unbreakable. It is available in any color, is permanently lustrous and warm to the touch. Molded at the fastest speeds possible with plastics, Tenite parts are mass-produced in a minimum of time and at relatively low cost.

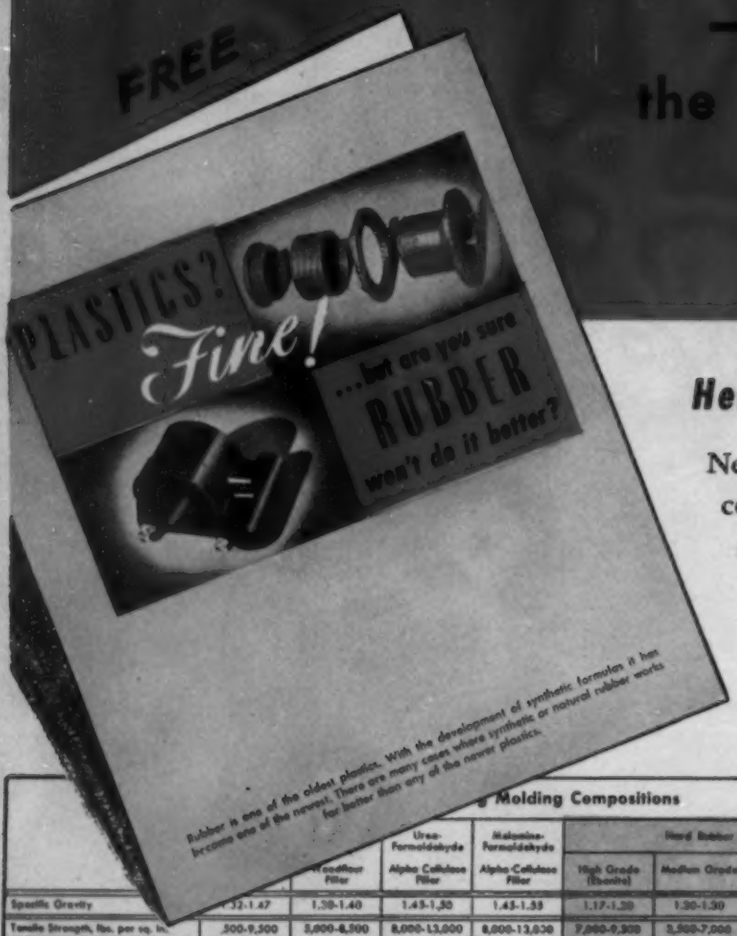
To obtain further information about the many uses of Tenite plastic, write to TENNESSEE EASTMAN CORPORATION (Subsidiary of the Eastman Kodak Company), KINGSPORT, TENNESSEE.

Tenite

AN EASTMAN PLASTIC

NEW GUIDE TO MATERIALS SELECTION

—helps clarify the position of rubber in the field of plastics


FREE
PLASTICS?
Fine!
...but are you sure
RUBBER
won't do it better?
Rubber is one of the oldest plastics. With the development of synthetic formulas it has become one of the newest. There are many cases where synthetic or natural rubber works far better than any of the newer plastics.

Help on materials selection

New and better plastic formulas are constantly emerging. Research on rubber is continuing and new compounds in synthetic and natural rubber are being developed. The most recent data has been assembled in this guide.

	Molding Compositions							Thermal Plastic Molding Compositions				
			Urea-Formaldehyde	Melamine-Formaldehyde	Hard Rubber			Methyl-Methacrylate	Polystyrene	Ethyl-Cellulose	Cellulose-Acetate	Cellulose-Acetate Butyrate
	Wood-flour Filler		Alpha Cellulose Filler	Alpha-Cellulose Filler	High Grade (Ebonite)	Medium Grade	Low Grade	Molding Powder	Molding Powder	Molding Powder	Molding Powder	Molding Powder
Specific Gravity	1.32-1.47	1.30-1.40	1.45-1.50	1.45-1.55	1.17-1.20	1.20-1.30	1.30 up	1.16-1.20	1.054-1.070	1.07-1.18	1.27-1.37	1.10-1.24
Tensile Strength, lbs. per sq. in.	500-9,500	3,000-8,500	8,000-13,000	8,000-13,000	7,000-9,500	3,500-7,000	1,500-3,200	4,000-10,000	5,000-9,000	2,500-9,000	1,500-8,200	1,400-6,700
Elongation, %	0.4-0.8	—	—	—	2.5-4.0	2.5-3.5	1.0-2.5	1-15	2-3	5-100	7-80	35-95
Compression Strength, lbs. per sq. in.	25,000-36,000	28,000-36,000	33,000-38,000	27,000-37,000	12,000	9,500	8,000-9,000	10,000-15,000	11,500-13,000	6,000-20,000	5,000-30,000	7,500-22,000
Flexural Strength, lbs. per sq. in.	9,000-12,000	8,000-15,000	10,000-16,000	10,000-16,000	15,000	10,000	7,500	10,000-19,000	8,000-19,000	3,000-12,000	2,000-12,000	1,600-12,000
Impact Strength, ft. lbs. per in. ½ x ½ in. notched bar, Izod Test	0.24-0.40	0.26-0.40	0.28-0.32	0.24-0.35	0.30-0.55	0.20-0.30	0.14-0.20	0.2-0.4	0.3-0.5	0.6-11.5	0.4-6.2	0.6-9.0
Hardness, Rockwell	M110-M120	M65-M75	M110-M130	—	HR90-HR105	HR85-HR100	HR85-HR100	M60-M112	M75-M90	R20-R110	R40-R120	R40-R120
Distortion under Heat °F (Softening Point)	260-300	270-290	260-280	333	160-180	160-180	160-180	145-190	170-175	120-200	100-215	100-160
Dielectric Strength, short-time volts per mil, ⅛ in. thickness	250-375	325-350	300-400	300-400	470	440-470	330-440	500	500-700	400-600	250-365	250-400
Power Factor, 60 cycles	0.03-0.30	0.04-0.38	0.039-0.052	0.043-0.045	.004	.004-.006	.006	0.05-0.07	0.0001-0.0003	0.003-0.015	0.01-0.06	0.01-0.04
Water Absorption, 24 hrs., percent	0.6-1.0	0.2-0.6	0.3-0.7	0.3-0.6	0.02	0.02	0.02 Variable	0.3-0.5	0.00-0.03	1.0-2.0	2.0-6.0	1.0-2.4
Burning Rate	Very low	Very low	Very low	Nil	Slow	Slow	Slow	Slow	Slow	Slow	Slow	Slow
Effect of Sunlight	Light shades discolor	Light shades discolor	None	Slight color change	Bleaches	Bleaches	Bleaches	Very slight	Yellows slightly	Slight	Slight	Slight
Effect of Weak Acids	None to slight depending on acid			None	None	None	None	Practically all	None	Slight	Slight	Slight
Effect of Strong Acids	Decomposed by oxidizing acids. Slight effect by reducing and organic acids		Decomposed or surface attacked	Decomposes	Decomposed by oxidizing acids. Little affected by others			Affected by oxidizing acids.		Decomposes	Decomposes	Decomposes
Effect of Weak Alkalies	Slight to marked depending on alkalinity			None	None	None	None	Practically all	None	None	Slight	Slight
Effect of Strong Alkalies	Decomposes	Decomposes	Decomposes	Attacked	None	None	None	Practically all	None	Slight	Decomposes	Decomposes
Effect of Organic Solvents	None on bleed-proof materials			None	Insoluble	Insoluble	Insoluble	Soluble	Soluble	Soluble	Soluble	Soluble
Effect of Metal Inserts	Inert	Inert	Inert	Inert	Inert	Inert	Inert	Inert	Inert	Inert	Inert	Inert
Machining Qualities	Fair-Good	Fair-Good	Fair	Fair	Excellent	Very Good	Good	Excellent	Fair-Good	Good	Good	Good
Clarity	Opaque	Opaque	Translucent-Opaque	Translucent	Opaque	Opaque	Opaque	Transparent 90-92% Light Transmission	Transparent 88-92% Light Transmission	Transparent, Translucent, Opaque		
Color Possibilities	Limited	Limited	Unlimited—Pastel Shades	Unlimited	Limited	Limited	Limited	Unlimited	Unlimited	Unlimited	Unlimited	Unlimited
Molding Qualities	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent
Mold Shrinkage, in. per in.	0.006-0.010	0.005-0.009	0.006-0.011	0.008-0.015	S.C. .016-.018 D.C. .030-.032	S.C. .016-.018 D.C. .030-.032	S.C. .014-.016 D.C. .028-.030	0.003-0.006	0.002-0.008	0.001-0.011	0.002-0.003	0.002-0.003

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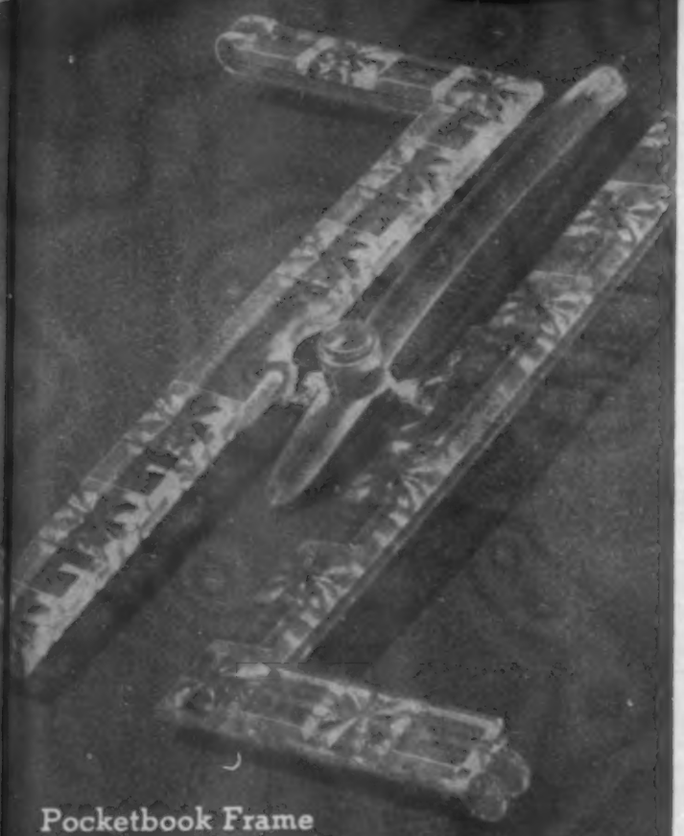

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Technical Section

DR. GORDON M. KLINE, Technical Editor

Acetylene as the basis of new plastics*

One of the important developments in Germany during World War II was the use of acetylene as a major raw material for the production of critical war materials—synthetic rubber, plastics, solvents, plasticizers, etc. Dr. W. Reppe, Director of Organic Chemical Research for I. G. Farbenindustrie A.-G., played a leading part in the discoveries which made these new syntheses from acetylene possible. In fact, this particular subject has now become known in Germany as "Reppe Chemistry." His wartime report to the I. G. Directors summarizing his investigations indicates their significance to the present and future development of plastics.

EXACTLY 11 years have passed since we in Ludwigshafen entered the acetylene field with the discovery of the vinyl ether synthesis from alcohols and acetylene. Since then, further investigations of the extremely reactive acetylene have resulted in the discovery of a great number of fundamentally new reactions of acetylene. In the beginning, the important vinylation reaction was systematically extended to any compounds of organic chemistry containing hydroxyl groups (higher aliphatic alcohols, hydroaromatic alcohols, heterocyclic alcohols, phenols, naphthols, etc.); apart from a few exceptions, these proved to be applicable in principle. Then followed the reactions with compounds carrying pyrrole and imidazole groups, such as indole, carbazole and benzimidazole, and the vinylation of the higher carboxylic acids (fatty acids, benzoic acid, hexahydrobenzoic acid, etc.) to the corresponding types of vinyl esters.

The following discovery was surprising: aromatic hydroxy compounds can react with acetylene under the influence of certain catalysts in such a manner that resinous polymers can be obtained directly through intermediately formed hydroxystyrenes.

Fundamentally new reactions resulted from the use of copper and silver or their compounds, especially their acetylides, as catalysts; this opened up the chemistry of the ethynyl compounds (aminobutyne, substituted propargylamine and alkynols or alkynediols), especially as far as their industrial utilization is concerned. The alkynol synthesis, apart from a new butadiene synthesis, will make practical a completely new industrial chemistry. Naturally, the scope of this development cannot be foreseen today.

The use of nickel catalysts in combination with carbon monoxide resulted in new syntheses for acrylic acid, its esters, amides and thioesters, as well as for the substituted acrylic acid derivatives. The knowledge acquired here led us to our investigations of the production of fatty acids and their esters from olefins, carbon monoxide and water or alcohols; acetic acid from methanol and carbon monoxide; and adipic acid from tetrahydrofuran, carbon monoxide and water.

The use of nickel catalysts in acetylene chemistry led, furthermore, to a completely new polymerization reaction of acetylene which does not yield aliphatic compounds as in the Nieuwland reaction, but cyclic polyolefins, such as cyclooctatetraene, cyclodecapentaene and cyclododecahexaene. Cyclooctatetraene can be produced specially easily and will after further investigations open a completely new class of substances within organic chemistry. As far as chemical properties are concerned, this substance will occupy an intermediate position between the aromatics and the olefins.

Vinyl ethers

The development of the vinyl ethers after their discovery in 1930 was very slow. The reasons for this were: 1) at that time it was considered to be technically impossible to work with acetylene under pressure and 2) applications for these new products, so completely different from anything known before, had not been worked out. Gradually, however, persistent work in this field fundamentally changed this situation so that, by the beginning of 1934, an experimental pilot plant could be constructed and, by the beginning of 1939, an industrial plant could get into production. Since then the vinyl ether production has increased to more than

* A report presented at the 25th Kuko (Plastics Committee) meeting in Frankfurt a. M. on November 21 and 22, 1941, by Dr. W. Reppe, I. G. Farbenindustrie A.-G. This translation was prepared by Mrs. I. G. Callomon and Dr. G. M. Kline, National Bureau of Standards.

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400 t./mo. and will be expanded soon to about 1000 t./mo. to meet existing demands.

The lower vinyl ethers are most important industrially, i.e., vinyl methyl ether, vinyl ethyl ether and vinyl isobutyl ether. At the present time, production of the higher ethers, such as the vinyl ethers of octadecyl alcohol and the mixed alcohols from coke, sperm oil and wax, is small due to the shortage of these alcohols. Recently, the vinyl decalol ether has gained in importance (about 50 t./mo.), partly as a substitute for the aforementioned higher vinyl ethers—especially in the production of the Densodrins. Their application is mostly in the field of adhesives, coatings and thickening agents for cable and leather oils. Oppanol C (produced by low temperature polymerization of vinyl isobutyl ether) has, unlike the products obtained in ordinary block polymerization, a K-value of 100 or more and can therefore also be used as a plastic for coatings.

Furthermore, emulsions produced by copolymerization of vinyl ethers, especially vinyl isobutyl ether with acrylic esters and vinyl chloride, have a very broad scope. In this group belong mainly the polymers Acronal 450, Acronal 550 and Acronal 430, and Vinoflex MP 400, a chemically resistant raw material for lacquers, which is compatible with Pergut (chlorinated rubber).

Apart from the vinyl ethers already on the market, a great number of new vinyl ethers have been produced and polymerized, and the possible applications of the polymers investigated. Among others the following vinyl ethers have been prepared:

Aliphatic vinyl ethers—Vinyl 2-ethylhexyl ether, vinyl nonyl ether, vinyl *sec.*-butyl ether, vinyl ether of C_6—C_9 alcohols; the last is of special interest. Their polymers and copolymers with one another and with lower vinyl ethers show good compatibility with Buna, to which they impart better spraying properties and appreciably increased tackiness.

Cycloaliphatic vinyl ethers—Vinyl cyclohexyl ether, vinyl *p*-butylcyclohexyl ether, vinyl decalylcarbinol ether, vinyl menthenyl-2-carbinol-8 ether, vinyl camphanylcarbinol ether. The alcohol bases of the latter products were obtained by the Oxo-process from the corresponding olefins (dipentene or camphene). As far as the usefulness of the new cycloaliphatic vinyl ethers is concerned, those vinyl ethers in which the ether group is situated directly on the ring produce hard resins by polymerization. Apart from vinyl decalyl ether already on the market, vinyl cyclohexyl ether and vinyl camphanylcarbinol ether, which can be polymerized to an extremely clear and colorless resin, are of special interest. Both of these polyvinyl ethers have application possibilities in leather impregnation and protective coatings as well as for rubber-compatible copolymers.

Aromatic vinyl ethers—Vinyl β-naphthyl ether, vinyl β-naphthylglycol ether, vinyl *p*-butylphenyl ether, vinyl methylphenylcarbinol ether, vinyl *p*-chlorophenylglycol ether. The investigation of the polymerization of these ethers, which so far has only resulted in dark-colored hard resins, has not been concluded.

Vinyl ethers with tetrahydrofuran or tetrahydropyran rings—Vinyl tetrahydrofurfurylcarbinol ether, vinyl 3-hydroxytetrahydrofuran ether, vinyl 2-methyl-3-hydroxytetrahydrofuran ether, vinyl 2,5-dimethyl-3-hydroxytetrahydrofuran ether, vinyl 3,5-diethyl-2-carbinol-tetrahydropyran ether; some of these are obtained by the new alkynol synthesis. All polyvinyl ethers containing an oxygen-heterocyclic group are characterized by a universal compatibility with a very wide range of lacquer raw materials.

Basic vinyl ethers—Vinyl diethylaminoethyl ether. So far, the polymerization of these vinyl ethers has been possible only in liquid sulfur dioxide. Especially promising are their copolymers with acrylic esters which can be produced in a mixture of methanol and water with persulfates as catalysts. A copolymer of methyl acrylate and vinyl diethylaminoethyl ether has been found to be satisfactory as a textile finishing agent as well as a sizing agent for PC (chlorinated polyvinyl chloride) and Perlon (polyamide) silk.

During the search for new catalysts for vinyl ether polymerization, it was found that the addition compound of boron fluoride with butyrolactone is especially suited for block polymerization of the higher vinyl ethers at low temperatures.

Lately, we succeeded in producing emulsion copolymers with vinyl esters, especially vinyl acetate, which can be successfully applied in the fields of protective coatings, sizing and adhesives.

Due to the slow removal of heat during block polymerization of vinyl ethers, attributable to their poor heat conductivity, discolored products of relatively low viscosity were obtained. Therefore, the vinyl ethers were sprayed as very fine drops into a reactor filled with contact gas, i.e., boron fluoride. In this way the vinyl ethers polymerize while falling freely. A polyvinyl decalyl ether produced by this method has, for example, a K-value of 51 as compared with about 20 for the block polymer prepared with boron fluoride dihydrate.

A new reaction of the vinyl ethers worth mentioning is that with hydrocyanic acid to yield α-alkoxypropionitriles; under the catalytic influence of bases like pyridine, this proceeds practically quantitatively. Also new is their reaction with ammonia to yield 2-methyl-5-ethylpyridine under the catalytic influence of copper-containing catalysts. By oxidation, 2-methyl-5-ethylpyridine is converted into 2,5-pyridyldicarboxylic acid and then through decarboxylation into nicotinic acid. Thus a technical nicotine synthesis seems to have come into the realm of reality through this reaction in combination with N-methylpyrrolidine which is accessible today on the alkynol basis.

At this time I would like to point out once more the possibility of manufacturing acetaldehyde via vinyl methyl ether. In semi-commercial experiments, this process has proved to be able to compete with the present mercury process Although the process via vinyl methyl ether is not more economical, it is of great importance from the physiological standpoint. Also, as is generally known, approximately 1 kg. of mercury is lost per ton of Buna manufactured. Thus the new process

would make the production of Buna independent of mercury which has to be paid for with foreign currency. It is regrettable that in spite of the many new aldehyde plants which have been built to meet the needs of the new Buna plants, this process has not been utilized. There is nothing new to report on the vinyl sulfides and the vinyl amines (Luvican).

Polyhydroxystyrenes

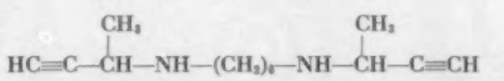
This new group of resins is developed from phenols, their homologs and substituted products, and acetylene under the catalytic influence of zinc and cadmium salts or amines. (Vinyl ethers are obtained with alkalies as catalysts.) The production of Koresin, a reaction product of acetylene and *p*-butylphenol, is now 60 to 70 t./mo. and will be expanded to 150 t./mo. soon. There are further possibilities for similar polyhydroxystyrenes in the fields of adhesives, plastics and lacquer raw materials. For adhesives, a cresol-xylenol-acetylene hard resin and a hydroxytolylcamphane-acetylene soft resin have been developed.

Of greater importance is the property of the soluble phenol-acetylene resins to react similarly to the novolaks. By the addition of small amounts of hexamethylenetetramine, they are changed into products which can very easily be hardened; these are of interest as lacquer raw materials as well as for plastics. In this way it is possible to prepare molding mixtures from phenol-acetylene resin and hexamethylenetetramine which correspond to the fast-molding mixtures of Type S. If one combines the acetylene novolaks with hexamethylenetetramine in solution or if one dissolves the fused mixture in suitable solvents, lacquers are obtained which harden very fast and which show very remarkable properties in combination with Luphens (phenolic varnish resins) or the soft resins which are used with Luphens. This is especially true for the resin prepared from phenol, triphenylolpropane, acetylene. The 4:1 combination of hydroxyphenylmenthene-acetylene resins with a resin made from *p*-tert.-butylphenol and formaldehyde (Alkyphen) results in a product with excellent oil and nitrocellulose compatibility; it is entirely independent of the patent of the Beckacite Ges. in the terpene-henol field.

Ethynyl compounds

AMINOBUTYNES AND PROPARGYLAMINES

On account of time and personnel shortages, little work has been done in the field of the aminobutynes. Only the hexamethylenediamine-1,6-dibutyne (3,12-dimethyl-4,11-diazatetradecadiyne-1,13)



is being tested as a spinning and textile auxiliary.

Analogously to the reaction product of dimethylolurea with 1 mol of acetylene, which is used in Luphen H, the reaction product of 1 mol of trimethylolmelamine and 2 mols of acetylene was prepared with the object of making an improved Luphen H type of product. The reactivity of this resin is considerably higher.

ALKYNOLS AND ALKYNEDIOLS

The alkynol synthesis for the special case of formaldehyde has been carried out in Ludwigshafen for about two years on a semi-commercial scale with the goal of obtaining a new butadiene synthesis (butynediol → butanediol → tetrahydrofuran → butadiene). Capacity there was about 80 t./mo. of 100 percent butynediol. Up to now, far more than 1000 tons of butynediol, calculated on a 100 percent basis, have been produced. About 3 weeks ago the big experimental plant in Schkopau started production. With the production of approximately 12 t./day of 100 percent butynediol in the form of a 35 percent aqueous solution, the plant is working perfectly up to the tetrahydrofuran stage.

Every one of the separate obtainable stages up to butadiene has developed into the starting point of a new ramification of chemistry, yielding products applicable for solvents, plasticizers, plastics and lacquer raw materials. Among the vast number of intermediates obtainable on the basis of the alkynol synthesis only, or at much lower cost, I might mention only the following (see Tables I and II):

Monohydroxy alcohols—Among the monohydroxy alcohols are the following:

1. Propargyl alcohol, from which can be obtained by partial hydrogenation allyl alcohol, by perhydrogenation *n*-propanol, and by addition of hydrochloric acid chlorallyl alcohol. The continuous production of propargyl alcohol by simple alkynol synthesis from 1 mol of acetylene and 1 mol of formaldehyde is still incomplete. It is easy to obtain 80 percent of propargyl alcohol and 20 percent of butynediol in discontinuous operation.
2. *n*-Butanol is obtainable up to 95 percent of the theoretical yield (remainder 1,4-butanediol) through energetic hydrogenation of the 35 percent aqueous butynediol crude solution using copper catalyst. By this process a very cheap butanol should be available.
3. *sec.*-Butanol can be easily obtained by perhydrogenation of the butyne-3-ol-2, produced from 1 mol of acetaldehyde and 1 mol of acetylene. The yield should be very high.

Dihydroxy alcohols—Through the alkynol synthesis, all butylene glycols have become accessible for industrial purposes easily and cheaply. Besides the 1,3-butylene glycol prepared in 1926 and 1,4-butylene glycol which became available on an industrial scale a few years ago, there exist today several methods to produce the 1,2- and 2,3-butylene glycols industrially. 2,3-Butylene glycol is obtained from butynol (prepared from acetaldehyde and acetylene) by addition of water to form acetoin, and subsequent hydrogenation; energetic hydrogenation of ketobutanediol (obtained by addition of water to butynediol) leads to 1,2-butanediol. 1,2-Propanediol is easily obtained by hydrogenation of acetol which is obtainable by addition of water to pro-

TABLE I.—SOME COMPOUNDS AVAILABLE FROM ACETYLENE AND FORMALDEHYDE BY THE REPPE SYNTHESIS

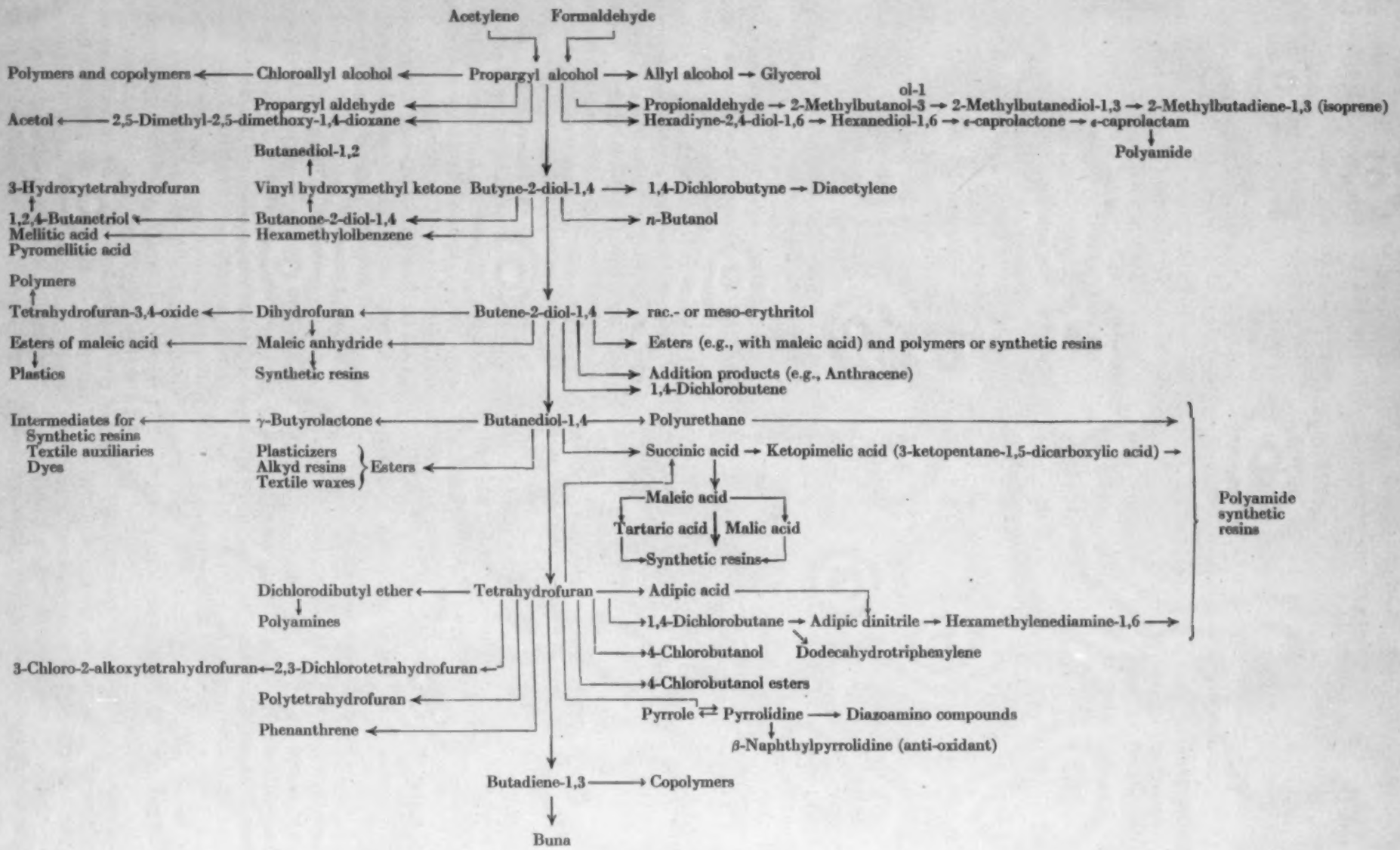
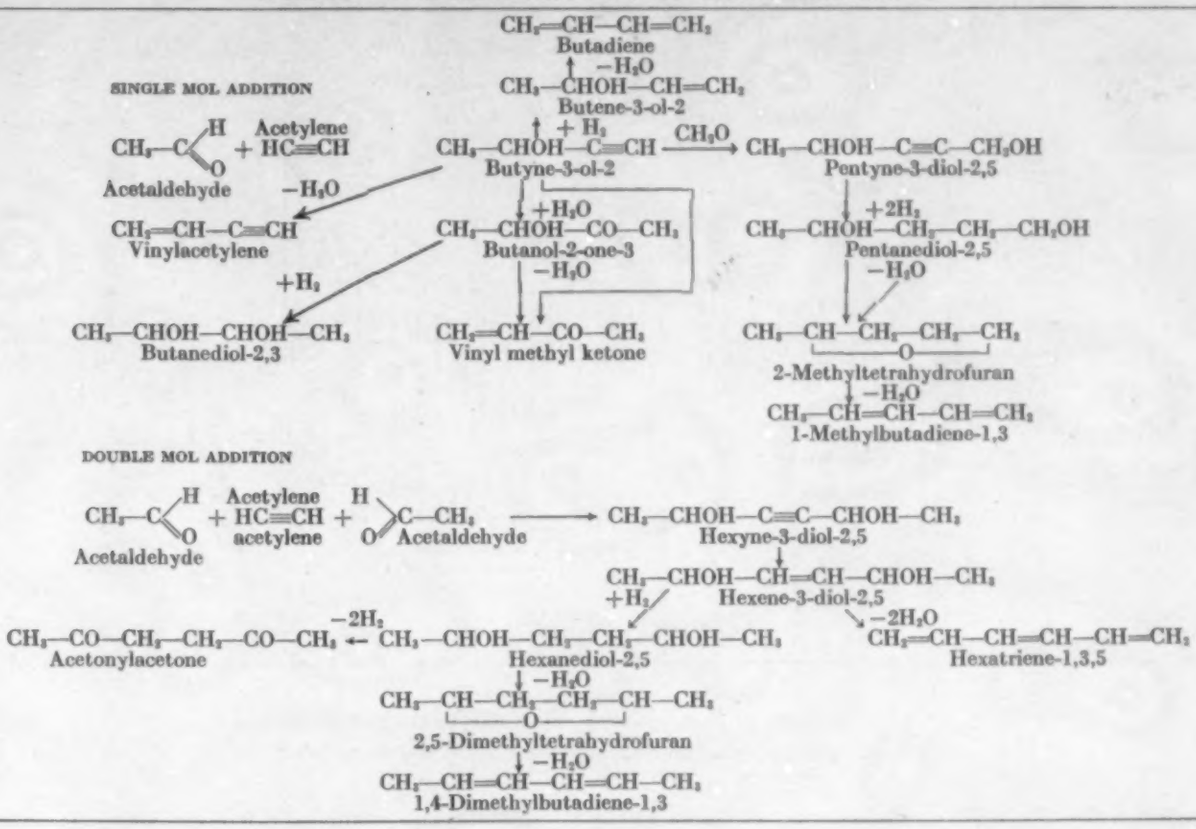


TABLE II.—THE REPPE ALKYNOL SYNTHESIS WITH ACETALDEHYDE



pargyl alcohol via 2,5-dimethyl-2,5-dimethoxy-1,4-dioxane. Pentanediol-2,5 is formed by hydrogenation of pentyne-3-diol-2,5 (the latter from butynol and formaldehyde in the presence of copper acetylide). Analogously hexanediol-2,5 is obtainable from hexynediol-2,5 (from 2 mols of acetaldehyde and 1 mol of acetylene). Hexanediol-1,6 is obtainable either according to the known method by hydrogenation of methyl adipate or by oxidation of 2 mols of propargyl alcohol with oxygen or air, using copper salts as catalysts, via hexadiyne-2,4-diol-1,6.

Worth mentioning are tri- and tetrabutylene glycols, obtainable either by reaction of δ,δ'-dichlorodibutyl ether (from tetrahydrofuran and hydrochloric acid) with 1,4-butanediol in the presence of alkali or according to Meerwein's tetrahydrofuran polymerization by discontinuing at polymerization degree 4. They are especially interesting as starting compounds for lacquer raw materials.

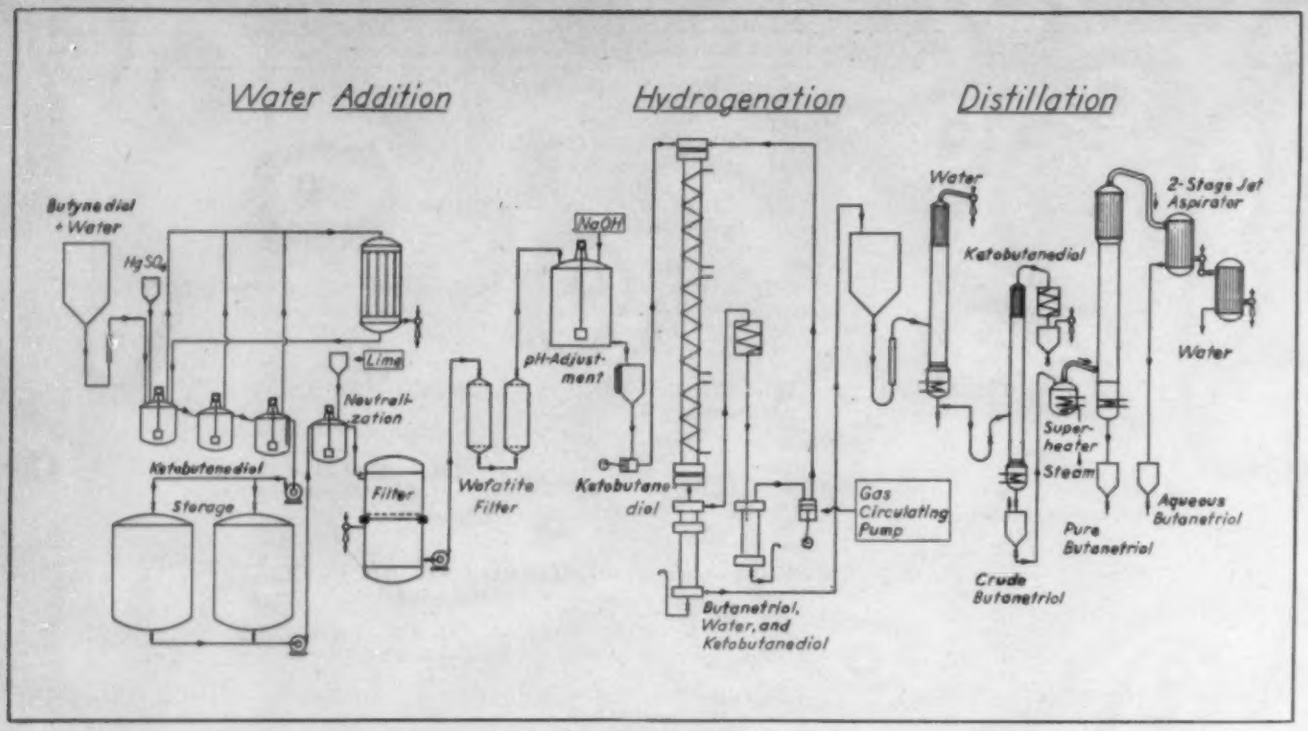
Trihydroxy alcohols—The alkynol synthesis is, furthermore, the key to a rational synthesis of a number of extremely important trihydroxy alcohols which will become of great importance for the production of explosives, plasticizers, alkyd resins and polyurethanes. Apart from glycerol, long known to be obtainable cheaply and easily from propargyl alcohol by partial hydrogenation to allyl alcohol, addition of hypochlorous acid and subsequent saponification, the two most important butanetriols—1,2,4-butanetriol and 1,2,3-butanetriol (methyl glycerol)—can be produced at very reasonable cost. The first is obtainable by hydrogenation of ketobutanediol, the product of addition of water to butynediol; the latter by conversion of butynol to butenol, addition of hypochlorous acid and subsequent saponification of the chlorohydrin. We have undertaken the manufacture of 1,2,4-trihydroxybutane on a semi-commercial scale. A diagram of the apparatus is shown in Fig. 1.

Tetrahydroxy alcohols—Among the tetrahydroxy alcohols, I only want to mention the synthesis of the normal erythritol which can be obtained from butenediol by the addition of hypochlorous acid and subsequent saponification. Homologous erythritols are analogously obtainable from pentene-3-diol-2,5, hexene-3-diol-2,5, etc. To obtain Hexite we see a possibility in the addition of 2 mols of hypochlorous acid to hexadiene-2,4-diol-1,6, obtained by partial hydrogenation of hexadiyne-2,4-diol-1,6, and subsequent saponification of the resulting dichlorohydrin.

DICARBOXYLIC ACIDS

It is possible to synthesize a great number of important dicarboxylic acids which, in turn, are suited for varying requirements in the production of plasticizers, alkyds, lacquer raw materials and plastics, especially polyamides (Table III). It must also be emphasized how profitable is the new process based on the alkynol synthesis.

Succinic, maleic and ketopimelic acids—The alkynol synthesis allows two methods for producing the important maleic acid. On the one hand, maleic acid can be



1—A diagram of the apparatus set up by I. G. Farbenindustrie A.-G. for the preparation of Butanetriol-1,2,4 from Butyne-2-diol-1,4

produced directly in about 80 percent theoretical yield by catalytic oxidation with air of the dihydrofuran obtained by dehydration of butenediol. On the other hand, succinic acid can be cheaply produced by oxidation of tetrahydrofuran obtained by dehydration of butanediol-1,4 with nitric acid in practically quantitative yield and with an outstanding nitric oxide balance (75 percent of the nitric acid can be regenerated) and in the form of succinic anhydride can be dehydrogenated by treatment with chlorine. A certain disadvantage of this method is that about 1 percent of chloromaleic acid is formed which can nevertheless be practically completely removed by pressing or distillation. The chlorination of the succinic anhydride can be carried further so that one will obtain monochloromaleic acid which is liquid at ordinary temperature or the solid dichloromaleic acid. Through condensation of polyhydroxy alcohols with monochloro- or dichloromaleic acid in the presence of a monocarboxylic acid one eventually obtains chlorine-containing alkyds which are of interest in combination with Pergut, Vinoflex, etc. The alkyd resins obtained in this way react with phenol polyalcohols accompanied by a turbulent separation of hydrochloric acid and water and form soft resins which can be hardened and which are completely soluble in aromatic hydrocarbons. These soft resins represent a new type of combination of phenolic and alkyd resins and appear to be superior to the present Luphens in their solubility and hardening properties.

Adipic acid and its substitution products—In the future the most important intermediate of polyamide chemistry, adipic acid, will be easily available purely aliphatically through the alkynol synthesis. Not only will this eliminate this use of the benzene and phenol needed for other purposes, but also it will tend to decrease production costs. The new adipic acid synthesis starts with tetrahydrofuran which under the influence of certain nickel catalysts reacts violently with 2 mols of carbon monoxide and 1 mol of water to be converted directly into adipic acid. The reaction is extremely exothermic, 7 kcal./mol. Depending on the reaction conditions, there is formed as a by-product either valeric acid through decarboxylation or valerolactone as a result of the combination of only 1 mol of carbon monoxide with the tetrahydrofuran. The process meanwhile is being placed on a continuous basis. Analogously, 2-methyl- and 2,5-dimethyltetrahydrofuran can be converted into the corresponding substituted adipic acids.

Dicarboxylic acids from γ-butyrolactone and δ-valerolactone—γ-Butyrolactone, which is easily and cheaply obtainable by the alkynol synthesis through dehydrogenation of butanediol-1,4 in practially quantitative yields, can be split by alkalies or strongly alkaline-reacting compounds to dicarboxylic acids or their intermediates. In this way one will obtain, through reaction with sodium cyanide, cyanobutyric acid, which can be converted by saponification into glutaric acid; with caustic soda, oxydibutyric acid results; with sodium sulfide, thiodibutyric acid; with sodium disulfide, dithiodibutyric acid, etc. Thiodibutyric acid upon oxidation yields sulfonyldibutyric acid; the simplest way to do this is with chlorine in aqueous solution.

Analogously, from δ-valerolactone one will obtain

TABLE III.—PREPARATION OF DICARBOXYLIC ACIDS BY THE REPPE SYNTHESIS

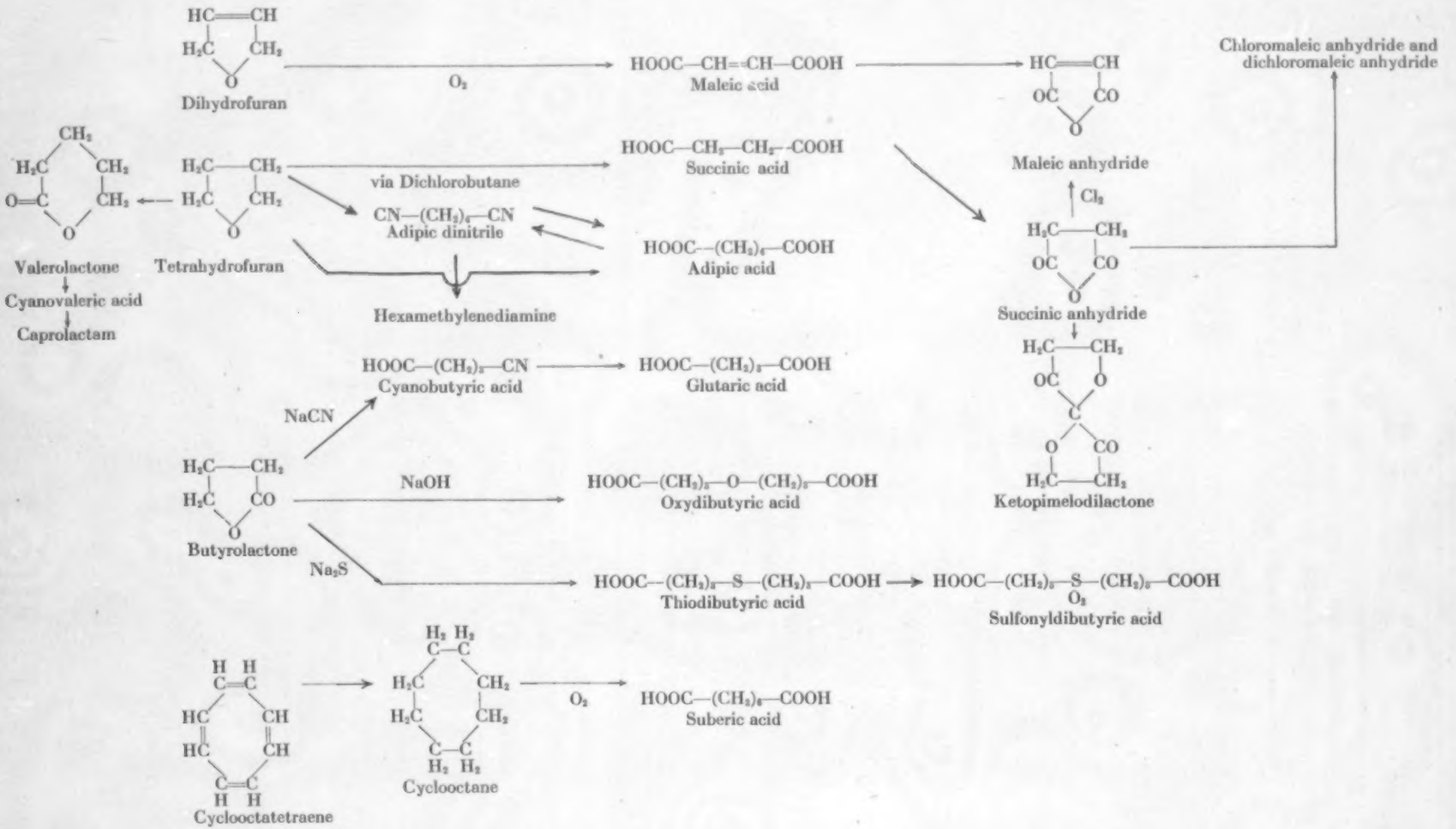
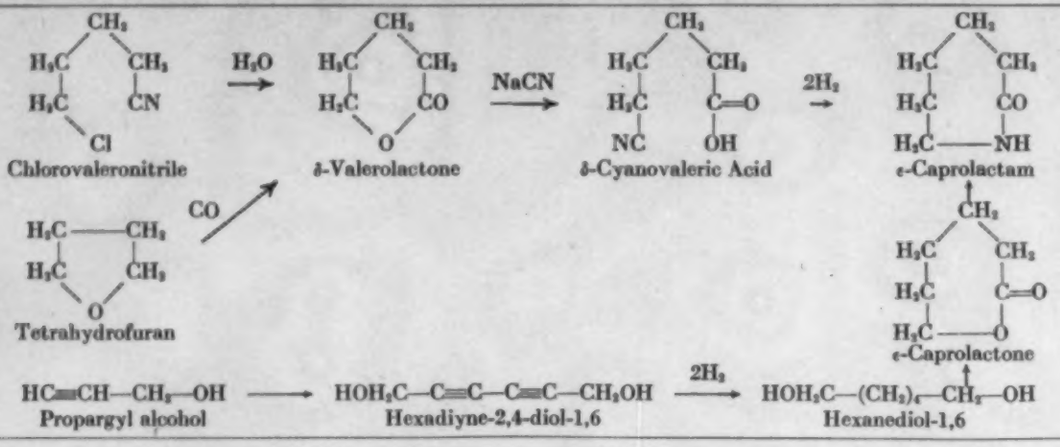


TABLE IV.—PREPARATION OF ε-CAPROLACTAM BY THE REPPE ALKYNOL SYNTHESIS



cyanovaleric acid and thiodivaleric acid. All the dicarboxylic acids are suitable as plasticizers in the form of their esters; for example, dibutyl thiodibutyrate for rubber, thiodibutyric esters of forerun fatty alcohol and Intrasolvan[1] for Igelits (polyvinyl chlorides); sulfonyldibutyric ester of 1,3-butylene glycol for cable lacquers. They are also suitable for use in the preparation of alkyds, waxes and lacquer raw materials, and in part also for polyamides.

The reaction of the γ-lactone with alcohols when heated in the presence of acid catalysts is noteworthy. In this way, alkoxy esters, such as ethyl ethoxybutyrate, butyl butoxybutyrate, nonyl nonoxyvalerate, etc., are easily obtainable.

Suberic acid—This interesting acid has become obtainable through a rational synthesis of the cyclooctatetraenes (described later in this report).

AMINOCARBOXYLIC ACIDS

Aminobutyric acid is easily available by the alkynol synthesis through saponification of the pyrrolidone produced from butyrolactone and ammonia. The same method also makes it possible to produce from purely aliphatic sources caprolactam, a product of great importance to polyamide chemistry. If only 1 mol of carbon monoxide is introduced into the tetrahydrofuran, δ-valerolactone is formed, which by reaction with sodium cyanide is converted into δ-cyanovaleric acid. Hydrogenation of the latter yields ε-caprolactam. Valerolactone can also be obtained by saponification of chlorovaleronitrile, produced by partial reaction of dichlorobutane with sodium cyanide. Finally, there is a further synthesis from propargyl alcohol: hexadiyne-2,4-diol-1,6 → hexanediol-1,6 → ε-caprolactone → ε-caprolactam (Table IV).

Very recently poly-N-vinylpyrrolidone has become of great medical importance. Polyvinylpyrrolidone is soluble in water as a colloid; it is being produced, in cooperation with Elberfeld, as an approximately 2.5 percent aqueous solution under the designation Periston and is used in blood transfusions and to prevent bleeding to death. In contrast to the formerly used physiological sodium chloride solutions or gelatin solutions, heterogeneous to the body, polyvinylpyrrolidone is easily worked off by the body without any injurious secondary effects on account of its acid amide structure. Periston has been very successful so far. Twenty to thirty thousand ampoules have been produced monthly, saving the lives of thousands of soldiers.

DIAMINES

In addition to the one important building stone of polyamide chemistry—adipic acid—, the second building stone—hexamethylenediamine—can be made available by the alkynol synthesis at an essentially more favorable cost than hitherto: first, according to the well-known method from adipic acid via the dinitrile and subsequent reduction and, secondly, by conversion of tetrahydrofuran with hydrochloric acid to 1,4-dichlorobutane, replacement of the chlorines by the nitrile group and reduction. Furthermore, there are other diamines available on the basis of the alkynol synthesis, for example, pentamethylenediamine besides a little piperidine by hydrogenation of glutarodinitrile.

I might say that the numerous products mentioned here represent only a small selection of the classes of compounds accessible on the basis of the alkynol synthesis and that it is by no means exhaustive. By including higher aldehydes, such as propionaldehyde, butyraldehyde, crotonaldehyde, benzaldehyde, etc.; the ketones, such as acetone, cyclohexanone, etc., on the one hand, and substituted acetylenes, such as methyl, phenyl, vinyl, diacetylene, etc., on the other hand, one could prepare innumerable new compounds or compounds which are practically not available at present, which could be used for a very wide range of purposes.

Acrylic acid compounds

At the last meeting of the Plastics Committee (Kuko) a report[2] was presented on the possibility of producing acrylic acid, its esters, amides and thioesters from alcohols, amines and mercaptans on the one hand and carbon monoxide and acety- (*Please turn to page 218*)

[1] "Plastics in Germany, 1939-1945, Part II," MODERN PLASTICS 23, 166 (Dec. 1945).

[2] Report of Dr. Reppe during the 24th Kuko meeting (Dec. 12, 1940). "A New Synthesis of Acrylic Acid and Its Derivatives," MODERN PLASTICS 23, 162-163, 210 (Nov. 1945).

Agricultural residues in plastics

Part II. Plasticizers and inorganic extenders in 25-percent phenolics

by R. V. WILLIAMSON,* T. F. CLARK† and T. R. NAFFZIGER†

PREVIOUS work[1] at the Northern Regional Research Laboratory[2] has shown that it is possible to formulate thermosetting phenol-formaldehyde molding compounds with excellent properties from 50 percent of agricultural residues ground to a flour and 47 percent of phenol-formaldehyde resin, provided that a proper selection of the resin is made. Some of these compounds, particularly those consisting of corncobs, with selected powdered resins, or with a water-precipitated resin which was prepared from a commercial liquid resin, yielded molded specimens that had flexural and tensile strengths considerably higher than those normally reported for general-purpose woodflour phenolics or those that were prepared with woodflour at this Laboratory.

Early in World War II it became apparent that there might be a serious shortage of phenol and formaldehyde. This possibility stimulated research on the production of phenolic compounds with a lower resin content. When formulation of compounds with only 25 percent of phenol-formaldehyde resin was attempted, it was found that the molded specimens had inferior strength properties and that manufacturing and molding conditions were too critical for industrial consideration. It was believed, however, that if a satisfactory plasticizer could be found, it would make possible the production of commercial molding compounds containing not more than 25 percent of phenolic resin.

Plasticized compounds

Liquid resin—When compounds were formulated with plasticizers and with only 25 percent of the resins used in the previous work, unsatisfactory results were obtained, especially with respect to the resistance of molded specimens to cracking when subjected to alternate soaking in hot water and to drying. Sixteen other liquid resins were tested. One, a varnish-type resin, could be combined with organic plasticizers to produce satisfactory results with respect to strength properties and resistance to cracking, but the amount of water absorbed was somewhat too high to meet A.S.T.M. specifications.

Water-precipitated resin—Improved water resistance in plasticized compounds, with only 25 percent of phenolic resin, was obtained by the use of a water-precipitated resin which was prepared from the above liquid resin by treatment with excess water and with heat. The results of these experiments not only showed that thermoplastic materials could be combined with the proper type of phenolic resin to produce thermosetting compounds having excellent molding and physical properties, but also indicated the possibility of producing thermosetting compounds with improved elasticity and toughness by the proper combination of resin and plasticizer. From a practical emergency point-of-view, however, the plasticized compounds were not satisfactory because the water-precipitated resin was not commercially available.

Inorganic-extended compounds

The commercial powdered resin used in the previous work had produced good results in resin concentrations of 47 percent, but was unsatisfactory when used with the amount of plasticizer which was required to produce satisfactory flow in the mold. In order to determine the plasticizer tolerance of this resin, a series of compounds was prepared with 50 percent of corncob flour, 25 percent of phenolic resin, and various amounts of Vinsol plasticizer and precipitated chalk, ranging from 2 percent of chalk and 23 percent of Vinsol to 25 percent of chalk and no Vinsol. The results were somewhat surprising in that they showed that the compound entirely extended with precipitated chalk had the best properties and showed remarkably good flow in the mold. This led to the study of other inorganic extenders and to the solution of the problem.

The technique of producing plasticized or inorganic-extended compounds was essentially that used in commercial practice; i.e., mixing the materials in a dough mixer, rolling on heated differential rolls and grinding in a burr mill. For those who may be interested in duplicating the experiments, a detailed description of the materials used, technique of production and discussion of results is presented.

EXPERIMENTAL PROCEDURE

Resins

Three phenolic resins were used in these experiments.

Resin 1—commercial liquid—This was a varnish-type Bakelite resin BV-3587 with a nonvolatile solids content at 221° F. of 86 percent. At the time of use the resin had aged for 6 months or longer at 40° F. This

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[1] R. V. Williamson, T. F. Clark and E. C. Lathrop, "Agricultural Residues in Plastics, Part I," MODERN PLASTICS, *23*, 158–60, 214 (Oct. 1945).
[2] One of the laboratories of the Bureau of Agricultural and Industrial Chemistry, Agricultural Research Administration, U. S. Department of Agriculture in Peoria, Ill.

resin produced satisfactory results in plasticized compounds with respect to strength and resistance to cracking of molded specimens when subjected to alternate hot-water soaking and to drying, but the amount of water absorbed was too high to meet A.S.T.M. specifications for general-purpose compounds.

Resin 2—water-precipitated—This resin was prepared from liquid resin 1 by precipitating the resin with water and heat and by washing the precipitated resin with hot water to remove water-soluble materials and to advance the polymerization of the resin to the desired degree. This resin overcame the inferior resistance to water absorption of the compounds prepared with resin 1 and produced good results in plasticized compounds. The detailed procedure for preparing the water-precipitated resin was as follows: Five parts of water and one part of liquid resin 1, by weight, were mixed in a jacketed dough mixer at approximately 212° F. until the resin formed a paste which was sufficiently stiff to permit removal of the aqueous fraction by decantation. Fresh hot water was added to cover the precipitated resin, and mixing and heating were continued for 15 minutes. The water was decanted and the washing and heating operation repeated until the polymerization of the resin had been advanced to the point where it became a tough rubbery mass. The precipitated and washed resin was sheeted out on cold differential rolls to remove excess water, dried at 100° F., and ground to a powder in a ball mill.

Resin 3—commercial powdered—This resin was Bakelite resin BR-1922,[3] which had produced good results with agricultural residues in normal concentrations of 47 to 50 percent. It did not produce satisfactory results when compounded with Vinsol plasticizer, especially with respect to resistance to cracking of molded specimens when subject to alternate soaking in hot water and to drying. A series of experiments, in which the plasticizer content was successively reduced and replaced by precipitated chalk, showed that the organic plasticizer could be completely replaced by precipitated chalk to produce compounds with good molding and physical properties. These results led to the experimentation with and study of other inorganic extenders.

Inorganic extenders

In addition to precipitated chalk, other inorganic extenders such as iron oxide,[4] titanium dioxide,[5] processed diatomaceous earth[6] and combinations of these materials have been found to produce good molding and physical properties when used in compounds with 50 percent of agricultural residues and 25 percent of phenolic resin. The specific effects which these inorganic extenders produced are discussed under the heading "Discussion of results." Clay and diatomaceous earth that contained small amounts of sand and clay were not satisfactory.

Organic plasticizers

Vinsol—This is a relatively low-priced resinous product obtained from pine wood pitch and has a melting point of about 240° F. Vinsol produced good results when compounded with the water-precipitated resin. The water-precipitated resin was soluble in molten Vinsol. Therefore, it was possible to advance the polymerization of the resin to a point where it would soften only to a rubbery condition at the temperature of molding and yet to obtain a free-flowing compound by the addition of Vinsol as plasticizer.

Modified Vinsol—Vinsol was modified to increase its insolubility in alcohol and to raise its softening point to 320° F., or about the temperature of molding. This modified Vinsol did not soften to a free-flowing condition at the temperature of molding, but when compounded with the liquid resin it dissolved or dispersed in the resin at the temperature of molding to form a free-flowing compound. The modified Vinsol was prepared as follows: 540 g. of Vinsol and 9 g. of sodium hydroxide, dissolved in 225 cc. of water, were mixed in a jacketed dough mixer at approximately 212° F. until a smooth paste was formed, and then 40 cc. of 37 percent formaldehyde was slowly added. Mixing was continued until a stiff paste was formed and a small amount of liquid exuded from the mass. Total time of mixing was about 40 minutes. The material was removed from the mixer and allowed to cool. The cooled material was hard and brittle and could be ground and used with or without drying. The softening point of the modified Vinsol could be controlled by the amount of alkali and formaldehyde used. No exudation of Vinsol or modified Vinsol occurred after extended aging at 105° C. of molded products.

Other organic plasticizers—Other plasticizers tested included furfural, furfuramide, furfuryl alcohol-lignin resin, Vinsol-tung oil resin, combinations of Vinsol, dibutyl phthalate and tricresyl phosphate, Vinsol-soybean fatty acid resin, rosin, and GR-S and butadiene-acrylonitrile synthetic rubbers. While the properties of the compounds produced with these plasticizers were different, none showed any advantage which was sufficient to overcome the comparatively low price of Vinsol.

Grinding of agricultural residues

Ball mill grinding—The agricultural residue flours which were used in most of these experiments were produced by coarsely grinding the residues in a hammer mill fitted with a $^1/_8$-in. screen, followed by ball mill grinding. A 30-lb. charge of coarsely ground residue was placed in a 30 by 24-in. ball mill with 100 lb. each of $1^1/_2$-, 2- and $2^1/_2$-in. Porox balls. The ball mill was allowed to run overnight or for a period of 15 to 16 hours. The ball-mill-ground flour was passed through an air separator to remove any coarse particles. Flour

[3] Preliminary investigations with Monsanto Resinox L-6839, a two-stage resin containing about 9 percent of hexamethylenetetramine, have indicated that this resin also might prove satisfactory in residue compounds with inorganic extenders. While it has been impossible to investigate extensively commercial resins, it is probable that other resins will have characteristics suitable for use in compounds with organic plasticizers or inorganic extenders.

[4] Mapico red No. 29.

[5] Titanox-A-MO.

[6] Dicalite "Speedflow."

TABLE I.—PHYSICAL PROPERTIES OF AGRICULTURAL RESIDUE COMPOUNDS WITH A PHENOLIC RESIN CONTENT OF 25 PERCENT AND WITH DIFFERENT KINDS AND PERCENTAGE

Number	Amount of agricultural residue	Resin: Type	Resin: Amount	Plasticizer: Type	Plasticizer: Amount	Inorganic material: Type	Inorganic material: Amount	Amount of black dye	Amount of zinc stearate	Flexural strength	Tensile strength
	percent		percent		percent		percent	percent	percent	p.s.i.	p.s.i.
		General-purpose woodflour phenolics, A.S.T.M. specification D 700-43T, type 2, minimum values								9,000	7,000
					CORNCOB COMPOUNDS						
1	50.0	Water-precipitated	25.0	Untreated Vinsol	20.40	$CaCO_3$	2.10	2.0	0.5	13,100	9,700
2	50.0[d]	Water-precipitated	25.0	Untreated Vinsol	20.40	$CaCO_3$	2.10	2.0	0.5	11,620	7,980
3	58.6	Water-precipitated	24.7	Untreated Vinsol	12.40	$CaCO_3$	1.80	2.0	0.5	12,700	9,120
4	60.0	Water-precipitated	25.0	Furfuramide	12.25	CaO	0.25	2.0	0.5	11,690	8,930
5	60.0	Water-precipitated	25.0	Vinsol soap	12.30	CaO	0.25	2.0	0.5	10,720	10,610
6	60.0	Liquid (commercial)	25.0	Vinsol soap	12.30	CaO	0.25	2.0	0.5	11,920	10,080
7	50.0	Powdered (commercial)	25.0	None	...	$CaCO_3$	22.50	2.0	0.5	12,300	9,440
8	50.0	Powdered (commercial)	25.0	None	...	$CaCO_3$ 15.00 Fe_2O_3 10.00		None	None	13,750	9,600
9	50.0	Powdered (commercial)	25.0	None	...	Dicalite[e]	25.00	None	None	13,510	9,320
10	50.0[d]	Powdered (commercial)	25.0	None	...	$CaCO_3$	25.00	None	None	9,390	7,890
11	50.0[d]	Powdered (commercial)	25.0	None	...	$CaCO_3$ 15.00 TiO_2 10.00		None	None	9,560	8,810
12	50.0[d]	Powdered (commercial)	25.0	None	...	TiO_2	25.00	None	None	10,470	9,320
13	50.0	Powdered (commercial)	47.5	None	...	None	....	2.0	0.5	12,240	9,550
					WHEAT STRAW COMPOUNDS						
14	50.0	Water-precipitated	25.0	Untreated Vinsol	20.40	$CaCO_3$	2.10	2.0	0.5	10,420	8,100
15	60.0	Water-precipitated	25.0	Untreated Vinsol	12.50	None	....	2.0	0.5	9,450	7,580
16	60.0	Water-precipitated	25.0	Furfuramide	12.25	CaO	0.25	2.0	0.5	10,060	8,250
17	60.0	Liquid (commercial)	25.0	Vinsol soap	12.25	CaO	0.25	2.0	0.5	9,200	8,710
18	50.0	Powdered (commercial)	25.0	None	...	$CaCO_3$	22.50	2.0	0.5	9,940	7,400
19	50.0[g]	Powdered (commercial)	25.0	None	...	$CaCO_3$	22.50	2.0	0.5	10,650	8,740
20	50.0	Powdered (commercial)	25.0	None	...	$CaCO_3$ 15.00 Fe_2O_3 10.00		None	None	9,680	7,730
21	50.0	Powdered (commercial)	25.0	None	...	Filter-Cel	25.00	None	None	9,530	6,500
					FLAX SHIVE COMPOUNDS						
22	50.0	Water-precipitated	25.0	Untreated Vinsol	20.40	$CaCO_3$	2.10	2.0	0.5	9,500	8,200
23	58.6	Water-precipitated	24.7	Untreated Vinsol	12.40	$CaCO_3$	1.80	2.0	0.5	9,600	7,000
24	60.0	Water-precipitated	25.0	Vinsol soap	12.30	CaO	0.25	2.0	0.5	12,460[h]	7,715[h]
25	60.0	Water-precipitated	25.0	Furfuramide	12.30	CaO	0.25	2.0	0.5	11,100	8,040
26	60.0	Water-precipitated	25.0	Furfuryl alcohol lignin	12.40	CaO	0.25	2.0	0.5	9,670	7,000
27	60.0	Liquid (commercial)	25.0	Vinsol soap	12.30	CaO	0.25	2.0	0.5	10,390	8,990
28	50.0	Powdered (commercial)	25.0	None	...	$CaCO_3$	22.50	2.0	0.5	9,370	7,950
29	50.0	Powdered (commercial)	25.0	None	...	$CaCO_3$ 15.00 Fe_2O_3 10.00		None	None	10,480	8,640
					CORN STOVER COMPOUNDS						
30	50.0	Water-precipitated	25.0	Untreated Vinsol	20.40	$CaCO_3$	2.10	2.0	0.5	10,580	7,090
31	60.0	Water-precipitated	25.0	Untreated Vinsol	12.50	None	....	2.0	0.5	8,970	6,750
32	60.0	Water-precipitated	25.0	Furfuramide	12.30	CaO	0.25	2.0	0.5	9,540	8,080
33	60.0	Liquid (commercial)	25.0	Vinsol soap	12.30	CaO	0.25	2.0	0.5	8,730	7,790
34	50.0	Powdered (commercial)	25.0	None	...	$CaCO_3$	22.50	2.0	0.5	9,600	8,890
					PEANUT SHELL COMPOUNDS						
35	50.0	Water-precipitated	25.0	Untreated Vinsol	20.40	$CaCO_3$	2.10	2.0	0.5	9,400	6,720
36	60.0	Water-precipitated	25.0	Untreated Vinsol	12.50	None	....	2.0	0.5	9,470	6,580
37	60.0	Water-precipitated	25.0	Furfuramide	12.30	CaO	0.25	2.0	0.5	9,660	7,000
38	60.0	Liquid (commercial)	25.0	Vinsol soap	12.30	CaO	0.25	2.0	0.5	8,960	6,540
39	50.0	Powdered (commercial)	25.0	None	...	$CaCO_3$	22.50	2.0	0.5	9,290	7,180
					HEMP HURD COMPOUNDS						
40	50.0	Water-precipitated	25.0	Untreated Vinsol	20.40	$CaCO_3$	2.10	2.0	0.5	9,480	6,880
41	60.0	Water-precipitated	25.0	Untreated Vinsol	12.50	None	....	2.0	0.5	9,840	7,290
42	60.0	Water-precipitated	25.0	Furfuramide	12.30	CaO	0.25	2.0	0.5	10,020	8,250
43	60.0	Liquid (commercial)	25.0	Vinsol soap	12.30	CaO	0.25	2.0	0.5	10,050	8,560
44	50.0	Powdered (commercial)	25.0	None	...	$CaCO_3$	22.50	2.0	0.5	9,160	8,250
45	50.0	Powdered (commercial)	25.0	None	...	$CaCO_3$	25.00	None	None	9,730	7,250
46	50.0	Powdered (commercial)	25.0	None	...	$CaCO_3$ 15.00 TiO_2 10.00		None	None	10,840	8,350
					RICE HULL COMPOUND						
47	50.0	Powdered (commercial)	25.0	None	...	$CaCO_3$	22.50	2.0	0.5	10,800	7,140

[a] Physical properties shown are optimum values.
[b] Water-absorption values are for 24 hours' immersion at 73° F. of disks 2 in. in diameter, 1/8 in. thick, molded for 2 1/2 min. at 350° F.
[c] Conditioning 1 hr. at 221° F.
[d] Corncobs ground through a hammer mill fitted with a 1/8 in. screen, boiled 1/2 hr., and ground on differential rolls.
[e] Dicalite, special "Speedflow" grade.
[f] Water absorption estimated for standard disks on basis of water absorbed by bottle caps.
[g] Water-cooked wheat straw, refined in a double-disk attrition mill.
[h] Specimens molded from powder passing No. 140 U. S. standard sieve.

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AND WITH DIFFERENT KINDS AND PERCENTAGES OF ORGANIC PLASTICIZERS AND INORGANIC EXTENDERS[a]

ount black ye	Amount of zinc stearate	Flexural strength	Tensile strength	Impact strength notched Izod	Water absorption gain in weight[b]	Specific gravity	Shrinkage: To room temperature	Shrinkage: After conditioning[c]
rcent	percent	p.s.i.	p.s.i.	ft.-lb./in. of notch	percent		in./in.	in./in.
							0.006 min.	
		9,000	7,000	0.24	0.80		0.008 max.	
.0	0.5	13,100	9,700	0.17	0.60	1.38	...	...
.0	0.5	11,620	7,980	0.24	0.66	..	...	...
.0	0.5	12,700	9,120	0.19	0.74	1.38	...	...
.0	0.5	11,690	8,930	0.19	0.92	..	...	...
.0	0.5	10,720	10,610	0.19	0.71	..	...	...
.0	0.5	11,920	10,080	0.18	1.01	..	...	...
.0	0.5	12,300	9,440	0.22	1.44	1.56	0.006	0.006
Vone	None	13,750	9,600	0.23	1.14	1.65	0.008	0.008
Vone	None	13,510	9,320	0.21	1.57	1.55	0.007	0.007
Vone	None	9,390	7,890	0.26	1.54[f]	1.60	...	...
Vone	None	9,560	8,810	0.29	1.37[f]	1.57	...	...
Vone	None	10,470	9,320	0.24	1.34[f]	1.65	...	...
.0	0.5	12,240	9,550	0.20	0.59	1.35	...	...
DS								
.0	0.5	10,420	8,100	0.20	0.48	1.37	...	...
.0	0.5	9,450	7,580	0.19	0.89	1.36	...	...
.0	0.5	10,060	8,250	0.20	1.02	..	...	...
.0	0.5	9,200	8,710	0.21	1.65	..	...	...
.0	0.5	9,940	7,400	0.21	1.06	1.54	0.008	0.008
.0	0.5	10,650	8,740	0.33	0.71	1.54	0.005	0.004
Vone	None	9,680	7,730	0.24	0.89	1.63	0.008	0.008
Vone	None	9,530	6,500	0.24	1.06[f]	..	0.006	0.007
S								
2.0	0.5	9,500	8,200	0.23	0.54	1.35	0.009	0.009
2.0	0.5	9,500	7,000	0.19	0.85	1.36	...	...
.0	0.5	12,460[h]	7,715[h]	0.16[h]	1.03	..	...	...
2.0	0.5	11,100	8,040	0.20	1.01	..	...	...
		9,670	7,000	0.24	1.08	..	...	...
.0	0.5							
.0	0.5	10,390	8,990	0.18	1.12	..	...	...
.0	0.5	9,370	7,950	0.21	0.79	1.53	0.007	0.007
Vone	None	10,480	8,640	0.24	1.05	1.61	0.009	0.009
DS								
2.0	0.5	10,580	7,090	0.23	0.62	1.37	...	...
2.0	0.5	8,970	6,750	0.16	0.98	1.37	...	...
2.0	0.5	9,540	8,080	0.23	1.09	..	...	...
2.0	0.5	8,730	7,790	0.20	1.40	..	...	...
.0	0.5	9,600	8,890	0.24	2.18	1.55	0.007	0.007
DS								
2.0	0.5	9,400	6,720	0.19	0.43	1.36	...	...
2.0	0.5	9,470	6,580	0.17	0.66	1.35	...	...
2.0	0.5	9,660	7,000	0.17	0.77	..	...	...
.0	0.5	8,960	6,540	0.20	0.82	..	...	...
.0	0.5	9,290	7,180	0.20	0.69	1.54	0.007	0.007
S								
2.0	0.5	9,480	6,880	0.23	0.48	1.36	...	...
2.0	0.5	9,840	7,290	0.18	0.62	1.37	...	...
2.0	0.5	10,020	8,250	0.21	0.83	..	...	...
2.0	0.5	10,050	8,560	0.21	0.69	..	...	...
2.0	0.5	9,160	8,250	0.25	0.54	1.54	0.009	0.008
Vone	None	9,730	7,250	0.23	0.66[f]	..	...	...
Vone	None	10,840	8,350	0.26	0.57[f]	..	...	...
2.0	0.5	10,800	7,140	0.26	0.43	1.56	0.007	0.007

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prepared in this manner showed the following sieve analysis:

U. S. standard sieve No....	80	100	140	200
Percent passing.....	99.5	98.5	95.0	85.0

Attrition mill grinding—Some of the hemp hurd flour used in these experiments was ground by one pass through a 36-in. double-disk attrition mill in an industrial plant to produce a product of the following sieve analysis:

U. S. standard sieve No.....	20	50	70	80	100	140
Percent passing....	98.6	94.0	86.4	80.7	76.4	65.7

This flour was produced at the rate of 13.6 lb. per horsepower hour. The fraction passing a No. 70 U. S. standard sieve was used in the preparation of compounds without any appreciable difference in physical properties of molded specimens from those obtained with finer ball-mill-ground flour except for a slight improvement in impact strength.

Grinding on differential rolls—Compounds that contained ball-mill-ground corncob flour and Vinsol plasticizer were somewhat low in impact strength. In order to improve impact strength, an attempt was made to produce a more fibrous material by the following procedure: coarsely ground cobs, of roughly $^1/_4$-in. size, were mixed in a Banbury mixer with 25 percent of water and subsequently ground on closely set differential rolls. The product was of a more fibrous character, and compounds made with it had improved impact strength, which met general-purpose specifications.

Wet shredding of wheat straw—Some experiments were made with wheat straw which was first coarsely ground in a hammer mill fitted with a $^1/_2$-in. screen, cooked for 1.75 hr. with water at 287° F., and refined with excess water in a 24-in. double-disk attrition mill. This material produced both improved impact strength and resistance to water absorption.

Mixing of materials

Materials may be mixed in any type of mixing machine, but the materials for most of these compounds were mixed in a small Banbury mixer for 2 min. at 150° F. Water was added to the mixture to the extent of 25 percent of the weight of the dry materials to facilitate mixing and the subsequent milling operation.

Milling on differential rolls

The mixed materials were transferred directly from the Banbury mixer to heated differential rolls and milled from 45 sec. to 3 min.—depending upon the character of the composition—at roll temperatures of approximately 212° F. on the fast roll and 300° F. on the slow roll.

In the early experiments, attempts were made to mill the compositions in such a manner that the degree of cure of the resin was advanced to the point where the powder produced by the grinding of the milled sheets was satisfactory for the most rapid molding of test specimens without conditioning of any kind prior to molding. This procedure was impractical for studying a wide variety of compositions because too much time was required and too much material was wasted in order to determine the exact milling conditions. Therefore, the procedure adopted was to mill the composition for the minimum time required to form a good sheet which, when cooled to room temperature, was sufficiently hard to grind properly in the subsequent grinding operation. Any further conditioning to prevent blistering in short molding cycles was accomplished by preheating the molding powder in an electric oven or electronic preheater previous to molding.

An important factor in the milling operation was found to be uniformity of milling, especially when the milling time was a minute or less. Uniformity of milling was accomplished by adjusting the space between the rolls to the weight of the charge so that the material fed into the rolls rapidly and yet formed a small bead between the rolls at the end of the milling period. Repeated use of the scraper or "doctor blade" was necessary in the early stages of the milling operation in order to prevent some of the material from riding too long on the bead between the rolls before becoming a part of the newly formed sheet. The spacing of the 12 by 6-in. rolls for a small batch of 0.53 lb. was usually such that the thickness of the cold-milled sheet was 0.065 inch. However, in the preparation of larger quantities of compound, 2.2 lb. of material were rolled at one time with the rolls spaced to produce a sheet 0.18 in. in thickness. The volume-weight ratio of the powder made from rolled sheets was found to decrease with a decrease in temperature of rolling.

Grinding of milled sheets

The milled sheets were coarsely ground by passing them through an Abbe mill with a $^5/_{32}$-in. screen. This coarsely ground material was ground in a burr mill to a powder which would pass a No. 35 U. S. standard sieve. This powder was then ready for the molding operation.

Molding of test specimens

Test specimens were molded from preforms of similar shape but slightly smaller than the molded test specimens. Trial specimens were usually molded without preheat. If defects such as blisters or warping occurred in the specimens molded from nonpreheated powder, the powder was preheated in a thin layer in an electric oven for from 3 to 8 min. at 220° F., or the preform was heated in an electronic preheater. The molding of a 28-mm., short skirt, bottle cap was often used as a rapid test of the molding properties of a composition. If a bottle cap could be molded from a composition in 30 sec. at 350° F. and 6750 p.s.i. with a closure time of the mold of 1.5 to 5 sec., the molding properties were considered satisfactory for molding test specimens. The closing time of a cup mold 2 in. in diameter and $2^1/_2$ in. deep was also used as a measure of the flow properties of some of these compounds. The closing time, when molding from an electronically

preheated disk at 300° F. and 6500 p.s.i., was only 10 sec., or only 3 sec. greater than the time of closure for the empty mold. A temperature of 350° F. and a pressure of 3000 p.s.i. were used in molding A.S.T.M. test specimens. Time of molding for flexural bars $^1/_2$ by $^1/_2$ by 5 in. was 7 min.; for tensile bars, 5 min.; and for water absorption disks $^1/_8$-in. thick, $2^1/_2$ minutes.

Tests

Except as noted, the tests were conducted in accordance with A.S.T.M. standards (1943). All molded specimens were conditioned prior to testing by heating at 221° F. for 1 hour. Tests were made at 73° F. and 50 percent relative humidity.

DISCUSSION OF RESULTS

The data as presented in Table I (chart inserted between pages 178 and 179 for a given residue may be classified as follows:

Compounds that contain organic plasticizers:
1. With liquid resin.
2. With water-precipitated resin.

Compounds that contain inorganic extenders and commercial powdered resin:
1. With dye and lubricant.
2. Without dye and lubricant.

At the top of Table I are presented the minimum specifications for general-purpose woodflour phenolics, which usually contain 47 to 50 percent phenolic resin. A comparison of these specifications with the properties of the agricultural residue compounds, containing only 25 percent of phenolic resin, shows that some of the compounds made with each residue meet the minimum general-purpose specifications for the properties tested.

A comparison of the properties of specimens molded from the different residue compounds shows that those containing corncobs are outstanding in flexural and tensile strengths, which in some cases are 50 percent above the minimum requirements of general-purpose specifications. Corncob flour has been extensively tested by a large manufacturer of molding compounds and has been pronounced very satisfactory. Peanut shell, hemp hurd and rice hull compounds are, in general, superior in resistance to water absorption and, in some cases, are nearly 50 percent better than the requirements for general-purpose specifications. However, it should be emphasized that the relative merits of the different agricultural residues might be altered under different conditions of compounding. For example, when other resins were used in the early stages of this study, corncob compounds produced very poor results, whereas they show superior flexural and tensile strengths under the conditions of these experiments.

The relative properties of corncob compounds, which contain 47.5 and 25 percent of phenolic resin, may be seen by comparing compound No. 13 with the other corncob compounds. Such a comparison shows that some of the compounds which contain only 25 percent of resin are superior to the compound with a resin content of 47.5 percent in all properties except in resistance to water absorption, and in some cases the difference in water absorption is only in hundredths of one percent.

Table II.—Estimated Saving in Cost of Raw Materials for an Inorganic-Extended Compound with 25 Percent Resin Content Equivalent in Volume to 1000 Lb. of a Molding Compound with 50 Percent Resin Content

	Compound with 50 percent resin		*Compound with 25 percent resin*	
	lb.	*dollars*	*lb.*	*dollars*
Agricultural residue flour at 1.5¢/lb.	500	7.50	500	7.50
Phenolic resin at 15¢/lb.	500	75.00	250	37.50
Inorganic extender at 3¢/lb.	...	...	250	7.50
Correction for increased density of 16 percent		...		8.40
Total cost of raw materials		82.50		60.90
Saving in cost of 25 percent compound				21.60
Saving in cost of 25 percent compound, %				26.21

The effect on impact strength of the method of grinding of the agricultural residue may be seen by a comparison of corncob compounds No. 1 and 2 and wheat straw compounds No. 18 and 19. The low impact value in each case resulted from the use of finely ground flour produced in a ball mill. The fiber used in corncob compound No. 2 with the higher impact value was prepared by grinding moist, crushed cobs on closely set differential rolls. The wheat straw compound No. 19, with the higher impact value, was prepared from wheat straw that had been cooked in water for 1.75 hr. at 287° F. and refined in a 24-in. double-disk attrition mill in the presence of excess water. This compound also showed improved resistance to water absorption.

The comparatively high impact values shown by the inorganic-extended compounds is rather surprising in view of the fact that the finely ground ball-mill flour was used and the inorganic materials were sufficiently fine to pass a No. 325 U. S. standard sieve.

The specific effect of inorganic extenders is exhibited by corncob compounds No. 10, 11 and 12, which show that improved strength properties were obtained by replacing part or all of the precipitated chalk with titanium dioxide. Iron oxide improved flow when it partially replaced precipitated chalk extender. Combinations of iron oxide and precipitated chalk extenders produced good results in corncob, wheat straw and flax shive compounds, but comparatively inferior results in corn stover, peanut shell and hemp hurd compounds. Of three samples of processed diatomaceous earths, which were tested as extenders, one proved to be very good, whereas the other two produced comparatively poorer results.

Dye and lubricant were found to add little, if any, value to the molding and strength properties of inorganic-extended compounds when introduced into the original mix. Some (*Please turn to page 220*)

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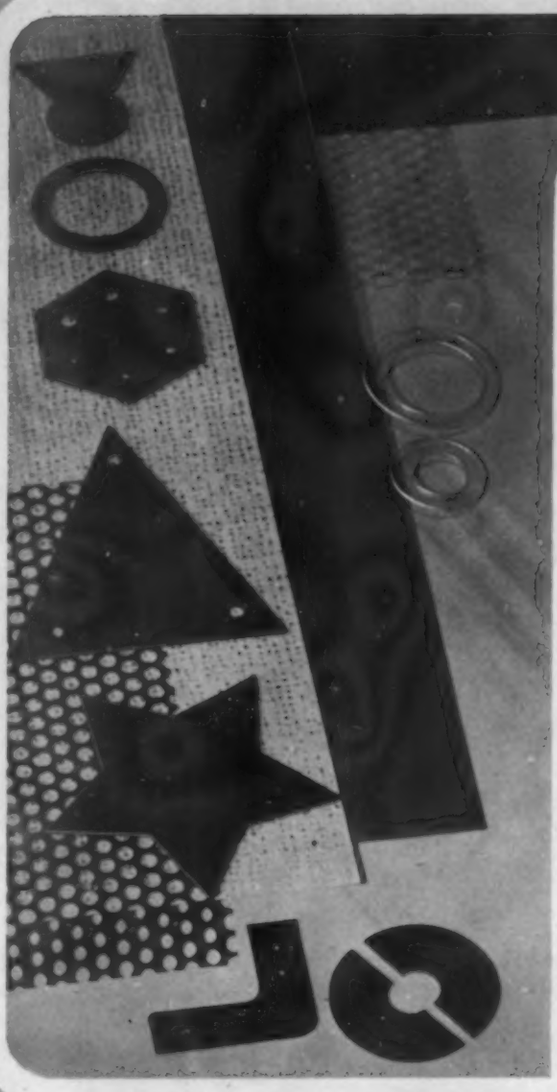

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General

ABSTRACTS ON UTILIZATION OF SAWDUST. M. E. Whalley. Natl. Research Council Can., N. R. C. No. *1285*, 103 pp. (1945). Abstracts of 160 papers as well as 152 patents on the utilization of sawdust.

RAYON FROM ALGINIC ACID BEING DEVELOPED IN ENGLAND. Chem. & Eng. News *23*, 1717–18 (Oct. 10, 1945). This article is a review of three papers which were published in British journals on investigations of alginic acid for rayon. The production and properties of rayons made from alginic acid and the metallic salts of the acid are described herein. Alginic acid is extracted from dried seaweed.

PREPARATION AND STORAGE OF ADHESIVES. F. D. Armitage. Printing and Allied Trades Research Assoc., Packaging Bull. No. *3*, 24 pp. (1945). The properties and applications of all types of adhesives are reviewed. Thirty-five references are included.

FOR BETTER USAGE. C. A. Southwick, Jr. Modern Packaging *19*, 131–2 (Nov. 1945). The results of an inquiry regarding definitions of the terms *films*, *foils* and *sheeting* are discussed.

ELECTROPLATED PLASTICS. E. E. Halls. Plastics (London) *9*, 504–11 (Oct. 1945). This is a review of the procedures for electroplating metals on objects made of plastics and the properties of the products.

LOW-PRESSURE LAMINATE FORMING DESIGN DATA AND APPLICATIONS. W. H. Arata. Product Eng. *16*, 753–5 (Nov. 1945). Advantages of articles and parts formed from laminated phenolic sheet are stated; vendor materials suitable for forming are listed; and data on types of molds, methods of heating sheets prior to forming, minimum bend radii on parts, and methods of fastening parts are discussed.

CARBOXYMETHYLCELLULOSE: USES AND APPLICATIONS. C. B. Hollabaugh, L. H. Burt and A. P. Walsh. Ind. Eng. Chem. *37*, 943–7 (Oct. 1945). Commercial usage of carboxymethylcellulose, usually in the form of its sodium salt, has increased rapidly in recent years. This product is a cellulose derivative formed by the reaction of monochloroacetic acid on alkali cellulose. The sodium salt is readily soluble or dispersible in water to form highly viscous solutions. Such solutions are utilized for their thickening properties, to aid in the suspension of pigments and other finely divided solids in liquid media, and to stabilize emulsions of various types. The applications are classified and discussed under the headings: textile industry, paper industry, food industry, drugs and cosmetics, ceramics, leather, paints and lacquers, adhesives, films and filaments and miscellaneous. Ninety-four references have been included.

CONTINUOUS POLYMERIZATION ACHIEVED IN SYNTHETIC RUBBER PRODUCTION. A. J. Gracia. Chemical Industries *57*, 628–30 (Oct. 1945). The process for the production of synthetic rubber by continuous polymerization is described. Results are discussed.

MINUTES OF I. G. CONFERENCE IN 1943 REVEAL INFORMATION ON GERMAN ORGANIC CHEMICALS INDUSTRY. Chem. & Eng. News *23*, 1841–5, 1900 (Oct. 25, 1945). The topics on production and developments of the I. G. Farbenindustrie included in this article are acetylene chemistry, ethylene chemistry, Buna production, Buna application developments, butadiene copolymers and Buna compounding agents.

TESTING LAMINATE ADHESION. Plastics (London) *9*, 512–13 (Oct. 1945). This is a summary of an article by W. Weigel which appeared in Kunststoffe *34*, 76 (1944). An improved testing method is described which is quick and simple in operation and tests all the laminations in a specimen. The specimen is bent as a cantilever beam by means of a simple, easily made device.

REPORT ON THE RUBBER PROGRAM 1940–1945. Rubber Reserve Co., 87 pp. (Feb. 24, 1945). The report covers all activities of the Rubber Reserve Co. from its creation to the present time.

COMPRESSION OF SOLID SUBSTANCES. P. W. Bridgman. Proc. Am. Acad. Arts Sci. *76*, 9–24 (1945). The compressibilities of 14 synthetic and natural rubbers are reported along with those of many other substances. Rubbers become brittle under pressure. Neoprene seems to be the most suitable material for high-pressure packing according to the author of this article.

Materials

EXTRACTION OF LIGNIN FROM HYDROLYZED LIGNOCELLULOSE. R. Katzen, F. G. Sawyer and D. F. Othmer. Ind. Eng. Chem. *37*, 1218–22 (Dec. 1945). The solubility characteristics of lignin present in acid-hydrolyzed lignocellulose were observed. Methanol was chosen as the most practical solvent for the separation and for the recovery of soluble lignin.

PAPER AND AMINO PLASTICS. C. H. Pottenger. Paper Trade J. *120*, 29–31 (June 7, 1945). The amino plastic resins, the urea-formaldehyde and melamine-formaldehyde types in particular, are discussed in relation to their use with paper in the manufacture of laminates and specialty papers.

METHACRYLIC ESTERS OF GLUCOSE AND OTHER CARBOHYDRATES. R. H. Treadway and E. Yanovsky. J. Am. Chem. Soc. *67*, 1038–9 (June 1945). The preparation of glucose pentamethacrylate, maltose octamethacrylate, dextrin trimethacrylate and starch methacrylate are described.

SYNTHETIC LIGNIN RESIN AND PLASTIC. A. J. Bailey and O. W. Ward. Ind. Eng. Chem. *37*, 1199–1202 (Dec. 1945). The condensation of lignin preparations with various condensing agents and catalysts was studied. The most successful reaction found is the condensation of butanol lignin with formaldehyde to produce a thermosetting resin. When the resin is properly compounded with plasticizer and filler, it produces a plastic with flexural strength, modulus of elasticity and impact strength, in either wet or dry condition, equal to those of plastics now in industrial use. Details for preparing the plastic are given, together with comparative quantitative data of flexural and impact strengths, modulus of elasticity and water absorption of the lignin plastic and commercial plastics.

BUTYL ACETYL RICINOLEATE. C. Soyka and H. F. Wilson. British Plastics *17*, 433–42 (Oct. 1945). Incompatibility of butyl acetyl ricinoleate samples with polyvinyl chloride resin is due to the presence of high boiling residues

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(estolides and ricinoleins) and other incompatible esters such as butyl ricinoleate, butyl oleate, butyl stearate, etc. Small proportions of butyl ricinoleate or butyl oleate improve the low temperature flexibility of polyvinyl chloride compounds made with butyl acetyl ricinoleate. Butyl stearate and the residues have an adverse effect except when present in small quantities. Distillation in vacuo and saponification of the distillate can be used as a method to determine with fair approximation the percentage of residues, incompatible esters and butyl acetyl ricinoleate present. Other methods such as the saponification, rotatory power, iodine value methods, etc., do not differentiate between the compatible and the incompatible fractions.

POLYMERIZATION OF CHLOROSTYRENE. II. S. N. Ushakov and P. A. Matuzov. J. Applied Chem. (U. S. S. R.) *17*, 538–45 (1944). The three chlorostyrenes polymerize completely at 200° C. in 5 minutes. The ortho and para isomers polymerize more readily than the meta. The meta isomer gives the highest molecular weight polymer, the ortho polymer is intermediate and the para polymer is lowest. Stored samples polymerized more readily than freshly distilled samples. The polychlorostyrenes have better heat stability than polystyrene. Polychlorostyrenes are noncombustible and soluble in aromatic hydrocarbons and chlorinated hydrocarbons. They are insoluble in alcohols and ethyl ether.

ETHYLENE GLYCOL ESTER OF HYDROLYZED LAC. ITS PREPARATION AND PROPERTIES. N. R. Kamath. London Shellac Research Bur., Bull. No. *6*, 10 pp. (1944). The preparation and properties of the ethylene glycol ester of hydrolyzed lac are described.

POLYVINYL PLASTICS. W. H. Mueller. Canadian Chem. & Process Ind, *29*, 395–7 (June 1945). The synthesis of monomeric vinyl acetate, polyvinyl acetate, polyvinyl alcohol and the polyvinyl acetals is briefly described.

POLYMERIZATION OF SHELLAC. S. R. Palit. J. Indian Chem. Soc., Ind. News Ed. *7*, 29–31 (1944). The fractionation and polymerization of shellac were studied.

TALL OIL ESTERS AS PLASTICIZERS FOR GR-S. W. I. Harber and C. S. Yoran. Ind. Eng. Chem. *37*, 953–6 (Oct. 1945). Tall oil, produced as a by-product in pulping of pine wood, is a rich source of resin and fatty acids. Previous work has shown that this material exerts a plasticizing effect on GR-S. The structure of tall oil was modified by esterification with alcohols. Most interesting were those esters derived from hydroxy compounds related to GR-S unit structure. They were superior to tall oil in rate of incorporation into the GR-S and general plasticizing action. Data are reported for the properties of tall oil esters of aliphatic, phenolic, cycloaliphatic and polyhydroxy alcohols.

EFFECT OF STORAGE ON LAC. M. Rangaswami and C. S. De. Indian Lac Research Inst., Bull. No. *56*, 12 pp. (1944). The changes in physical and chemical properties of lac were determined over storage periods up to 40 months.

Applications

PREPARATION OF ZEIN FIBERS BY WET SPINNING. C. B. Croston, C. D. Evans and A. K. Smith. Ind. Eng. Chem. *37*, 1194–8 (Dec. 1945). A new method for producing textile fibers from zein and the equipment used in the process are described. Zein fibers which have a high tensile strength and wool-like properties are produced from alkaline dispersions of zein. The spinning dispersions are formulated to give a product of high viscosity by the use of denaturing agents, such as alcohol or urea, or by aging the solutions. The filaments are coagulated in an acid bath in which salts may or may not be used. The coagulated filaments are given a mild formaldehyde precure prior to stretching and drying. The influence of the extent of precure on the load-elongation properties of the fiber and fiber strength is determined. Shrinkage and water resistance of the fibers are controlled by acetylation followed by a strong formaldehyde treatment.

POLYETHYLENE FILM. Modern Packaging *19*, 107, 170 (Nov. 1945). The first packaging application of polyethylene film is described. Polyethylene was used to package tablets of mepacrine, an antimalarial drug. Other conventional packaging materials were unsatisfactory, whereas when the tablets were sealed in polyethylene film they stood months in tropical conditions without deteriorating.

WHAT ABOUT PLIOFILM? Modern Packaging *19*, 116–17, 172, 174 (Nov. 1945). The properties of rubber hydrochloride packaging film are reviewed.

POLYVINYL ALCOHOLS AND ACETATES FOR PACKAGING. J. W. Criss. Modern Packaging *19*, 160–1, 182, 184 (Oct. 1945). Polyvinyl alcohols and polyvinyl acetates are used in packaging in the form of films, coatings, laminations, binders and adhesives. The properties and applications of these materials are reported.

RESISTANCE TO SHIPPING HAZARDS OF GLASS AND PLASTICS. Modern Packaging *19*, 124–5, 184, 186 (Oct. 1945). The results of laboratory tests on bottles made of glass, cellulose acetate plastic, cellulose acetate butyrate plastic and polystyrene plastic are reported. The bottles were placed in cartons and tumbled in a large rotating drum. The most durable bottles were made of cellulose acetate followed by cellulose acetate butyrate. The polystyrene and glass bottles were about equal in performance but inferior to those made of the cellulosic plastics.

MANUFACTURE OF BRAKE LININGS. B. S. Gidvani. Plastics (London) *9*, 541–8 (Nov. 1945). The formulation and manufacture of brake lining materials are reviewed.

FOUR NEW PLASTICS IN USE IN AVIATION. T. A. Dickinson. Aero Digest *51*, 73–4, 126 (Dec. 1, 1945). A vinyl plastic protective covering material, a plastic composition used for making jigs, fixtures and molds, a cast phenolic plastic and a resinous adhesive are described in this article.

SAFETY EQUIPMENT INDUSTRY LOOKS TO PLASTICS. F. J. Moss. Pacific Plastics *3*, 18–20 (Nov. 1945). The applications of plastics in the manufacture of safety equipment are described.

A LIGHTWEIGHT FIBERGLAS-PLASTICS CAST DEVELOPED BY SEATTLE FIRM. Pacific Plastics *3*, 21 (Nov. 1945). A bandage, consisting of 80 percent cellulose acetate fiber and 20 percent glass fibers, is immersed in a mixture of acetone, methyl salicylate and hydrocarbons, and applied to the body. The fabric fuses together in a few minutes into a rigid, smooth cast. These casts are more readily made and are lighter than plaster casts. They are permeable to X-rays.

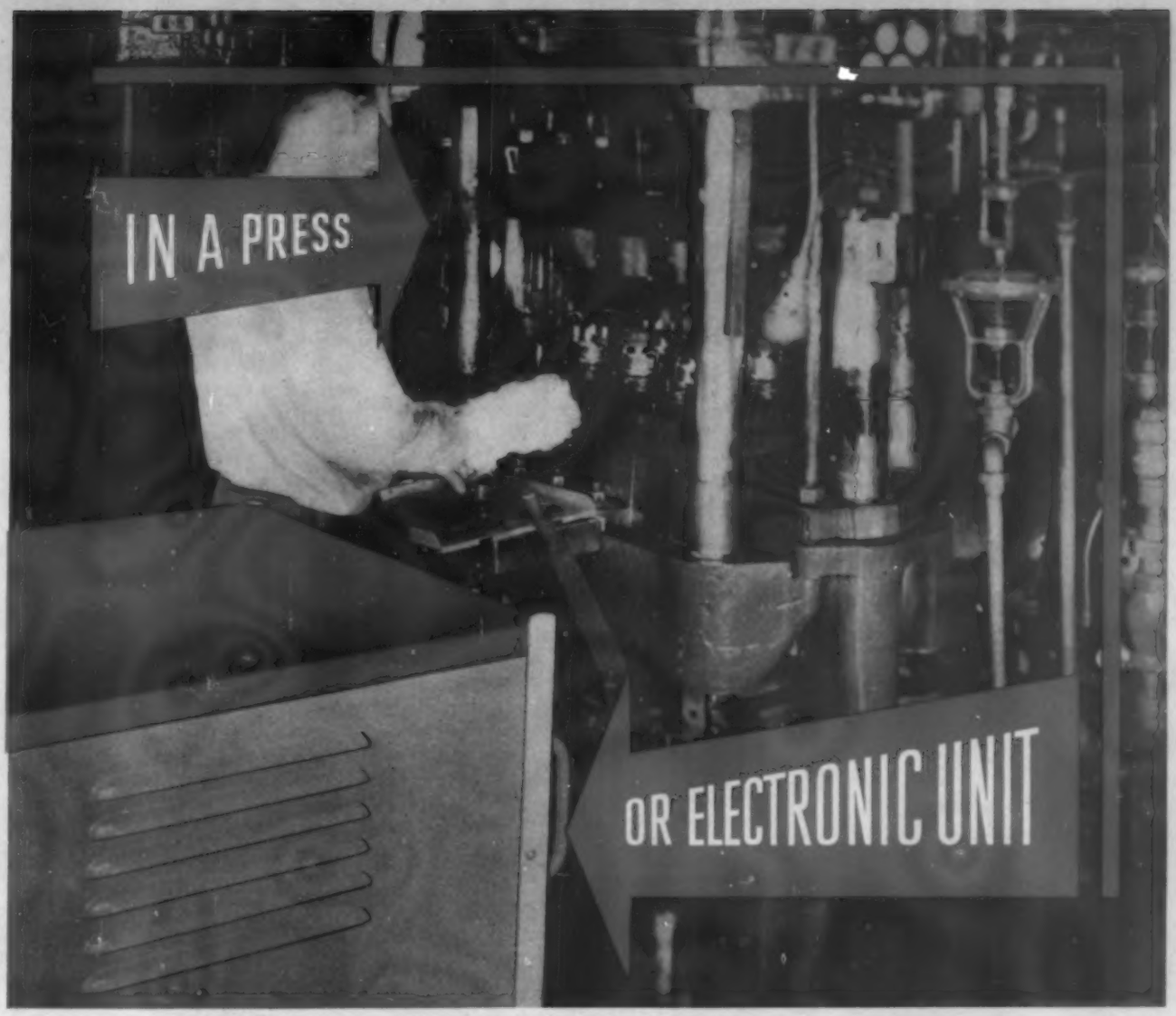
PLASTICS WITH ALUMINUM IN BUILDING. Plastics (London) *9*, 562–5 (Nov. 1945). Partition walls and kitchen and bathroom fittings made of plastics and aluminum are described.

Coatings

ANTISKINNING AGENTS DERIVED FROM NITROPARAFFINS. H. G. Johnson. Ind. Eng. Chem. *37*, 1176–8 (Dec. 1945). A number of nitroamines and polyamines were tested as antiskinning agents for a badly skinned tung oil varnish. The results are given and compared with those obtained from other antioxidants.

PLASTICS AID IN BATTLE AGAINST CORROSION. Pacific Plastics *3*, 13–17 (Nov. 1945). Many specific applications of phenolic and vinyl resin coatings to industrial process equipment to protect against corrosion are described.

ACTION OF SOLVENTS AND LACQUERS ON SYNTHETIC-RESIN-COATED WIRE. E. Greulich. Kunststoffe *34*, 51–7 (1944); Chem. Abstracts *39*, 4238 (Sept. 20, 1945). The effect of various organic liquids on the hardness of synthetic resin lacquers for coating wire was investigated.



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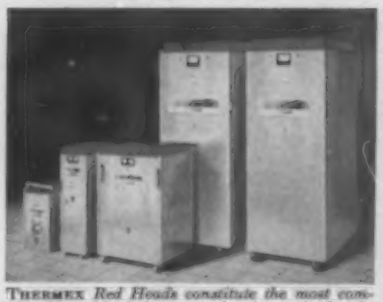

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Technical Briefs

Abstracts of articles on plastics in the world's scientific and engineering literature relating to properties and testing methods, or indicating significant trends and developments.

Engineering

PROPERTIES AND APPLICATIONS OF SARAN PIPE. D. R. Williams. Chem. & Met. Eng. *52*, 112–13 (Nov. 1945). Data are presented to show advantages and limitations of polyvinylidene chloride plastic pipe in chemical plant installations. Pertinent physical and chemical properties are discussed.

CARBON BLACK IN WAR AND PEACE. L. H. Cohan. Chem. Eng. News *23*, 2078–85, 2145 (Nov. 25, 1945). The properties and manufacture of the various types of carbon black are reviewed. One hundred and eleven references.

THERMOPLASTIC LEATHER-RESINOID. A. Colin-Russ. British Plastics *17*, 402–9 (Oct. 1945). The peculiar features of thermoplastic forms of uncondensed leather-resinoids are discussed as derived from chrome and vegetable tannages, with ultimate reference to plasticization. About 60 substances of varied chemical constitution are surveyed to establish the structural effects of their functions, if any, as solvents and plasticizers. The polar nature of certain groups in the protein structure is considered throughout these studies on an electronic basis with particular reference to interaction with molten hydroquinone. Diethyleneglycol is outstanding among liquid plasticizers, and sulfosalicylic acid among solids, except that amides also function excellently where nitrogenous plasticizers are desired. It is believed that protein plasticization is fundamentally contingent upon hydrogen-bond formation and persistence according to the experimental conditions.

Chemistry

COPOLYMERIZATION. Part II. F. M. Lewis, F. R. Mayo and W. F. Hulse. J. Am. Chem. Soc. *67*, 1701–5 (Oct. 1945). The copolymerization of acrylonitrile, methyl methacrylate, styrene and vinylidene chloride, taking two monomers at a time, were studied at 60° C. with benzoyl peroxide as catalyst. The good correlation with the copolymerization equation which was previously developed indicates that the assumptions made about the chain growth process are substantially correct. The relative reactivities of the four kinds of monomers with the four kinds of free radicals are compared. The results show clearly that reactions of free radicals with double bonds are specific, that both the ratio and the order of reactivities of a monomer series change as the radical is changed. There is no simple relation between the relative tendencies of two monomers to enter a copolymer and their rates of polymerization alone. The copolymerization equation is a useful tool for pointing out and measuring the factors which govern copolymerization reactions. Difficulties in the analysis of certain polymers are discussed.

EFFECT OF PERSULFATE CONCENTRATION IN EMULSION POLYMERIZATION OF STYRENE. I. M. Kolthoff and W. J. Dale. J. Am. Chem. Soc. *67*, 1672–4 (Oct. 1945). The rate of emulsion polymerization of styrene was investigated in the absence of oxygen at 30° C. It was found that the rate of conversion is proportional to the square root of the concentration of persulfate which was used as the "catalyst." In this respect the kinetics of the emulsion polymerization of styrene is comparable to that of the bulk polymerization. At a given persulfate concentration the rate remains unaffected by the presence of a chain transfer agent like mercaptan when the concentration of the latter varies between zero and two parts per 100 parts of styrene. This was anticipated on the basis of the classical picture of the bulk polymerization of styrene.

THE DIRECT SYNTHESIS OF PHENYLCHLOROSILANES. E. G. Rochow and W. F. Gilliam. J. Am. Chem. Soc. *67*, 1772–4 (Oct. 1945). The general reaction of hydrocarbon halides with elementary silicon is applied to the direct synthesis of diphenyldichlorosilane from chlorobenzene and commercial silicon. The effects of various catalysts are described, and conditions for carrying out the reaction and for separating the phenylchlorosilanes by distillation at atmospheric pressure are given.

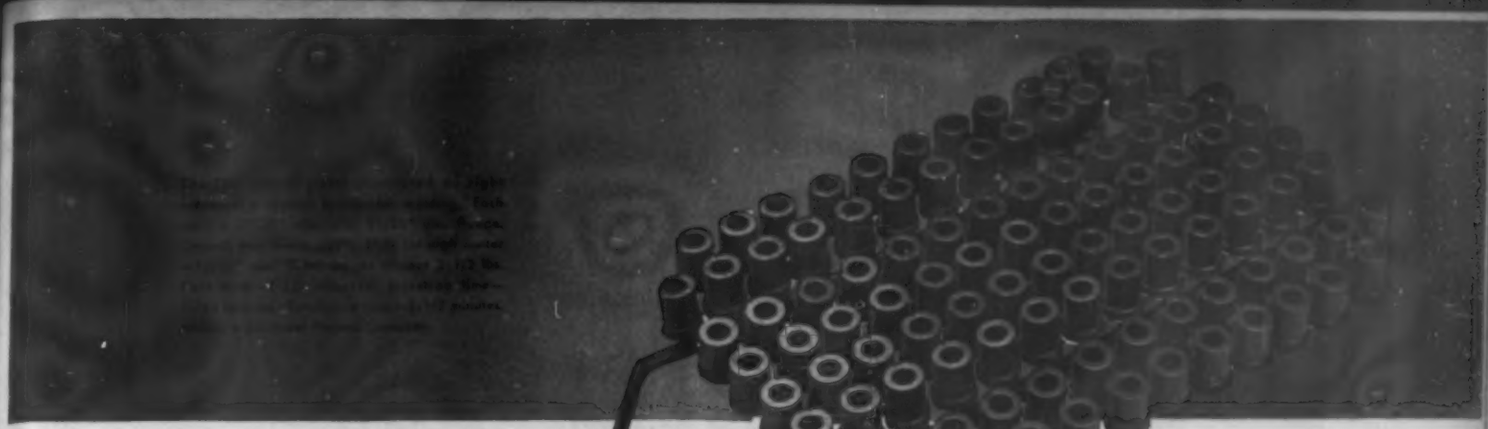
INFLUENCE OF HYDROSTATIC PRESSURE ON SEDIMENTATION VELOCITY IN THE ULTRACENTRIFUGE. H. Mosimann and R. Signer. Helv. Chim. Acta *27*, 1123–7 (1944); Chem. Abstracts *39*, 3476–7 (Aug. 20, 1945). The decrease in the specific sedimentation constant with distance from the center of rotation for cellulose nitrate dispersed in acetone practically disappears when corrections are made for the effect of pressure on the properties of the solution such as viscosity and density. Although such corrections are negligible for water they are appreciable for organic solvents.

THE DEGRADATION OF HIGH POLYMERS. R. F. Tuckett. Trans. Faraday Soc. *41*, 351–9 (July 1945). The random degradation of high polymers is treated as a problem in statistics which can be solved by the same technique as that for determining the partition of energy among a set of harmonic oscillators. The Darwin-Fowler method is used in which the various quantities required are expressed as coefficients in related power series: these are then evaluated as contour integrals by the method of steepest descents. The size distribution functions for the degraded material are then derived directly together with the various average molecular weights by the use of differential operators. On this formulation, the extension to systems which are initially polydispersed is immediate and the method is then applied to a specific case of non-random degradation in which preferential splitting at the ends of the chains occurs. The kinetics of this type of degradation, which is found experimentally, are also discussed.

THE PREPARATION OF VINYL AND ALLYL CHLOROSILANES. D. T. Hurd. J. Am. Chem. Soc. *67*, 1813–14 (Oct. 1945). Allyl and vinyl chlorosilanes were prepared by the direct reaction of allyl chloride and vinyl chloride with copper catalyzed silicon contact masses. Vinyl chlorosilanes were prepared by the chlorination and subsequent dehydrochlorination of ethyl chlorosilanes. The alkylene chlorosilanes were hydrolyzed to yield alkylene polysiloxanes that are capable of further polymerization through their organic unsaturation.

Properties

METHODS OF SPECIFYING THE PROPERTIES OF VISCOELASTIC MATERIALS. T. Alfrey and P. Doty. J. Applied Phys. *16*, 700–13 (Nov. 1945). Seven methods (Voigt model, Maxwell model, operator equation, mechanical impedance function, creep curve, relaxation curve and dynamic modulus function) of specifying viscoelastic behavior are discussed. A number of exact relations between these methods of specification are worked out in detail. The majority of these relations are simple enough to be of practical value although a few are too cumbersome. Approximate relationships between the creep curve, the relaxation curve, Maxwell model and Voigt model are discussed; numerical examples show the magnitude of errors introduced



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by the approximation to be small even in quite unfavorable cases. A consideration of the practical utility and physical meaning of the various methods of specification distinguishes between 1) those of a general descriptive value and those of direct experimental value; 2) those useful in a phenomenological study of mechanical behavior and those more suited to a formulation of molecular theory. A summary of the present molecular theories is presented together with their interpretation in terms of the Voigt and Maxwell specifications.

TENSILE STRENGTH IN RELATION TO MOLECULAR WEIGHT OF HIGH POLYMERS. P. J. Flory. J. Am. Chem. Soc. *67*, 2048–50 (Nov. 1945). The relation of the molecular weight of high polymers to their tensile strength is the subject discussed.

PHYSICAL TESTING OF GLUE COMPOSITIONS. W. C. Griffin and E. G. Almy. Ind. Eng. Chem. *37*, 948–52 (Oct. 1945). Viscosity, tensile strength and gel strength data on a wide range of glue compositions are presented. A comparison of glycerol and sorbitol as softeners is presented, along with data on combinations of the two. Physical properties deteriorate rapidly with an increase in water content. In general, compositions softened with sorbitol show higher viscosity, higher gel strength and higher tensile strength than those softened with glycerol. These physical properties are very sensitive to water content of the composition.

Testing

TWO ELECTRON MICROSCOPICAL REPLICA TECHNIQUES FOR THE STUDY OF ORGANIC SURFACES. R. B. Barnes, C. J. Burton and R. G. Scott. J. Applied Phys. *16*, 730–9 (Nov. 1945). The problem of examining opaque surfaces in the electron microscope is discussed and it is shown that none of the methods heretofore described is completely satisfactory for the examination of organic surfaces. Two new methods, a low-pressure polystyrene-silica technique and a silver-silica double evaporation method are described, and it is demonstrated that they allow observation of organic as well as metallurgical surfaces. Electron micrographs of fiber surfaces, paint films, biological material, ores and metals are included to illustrate the utility of these techniques.

MEASURING PERMEABILITY TO CARBON DIOXIDE AND WATER VAPOR. J. D. Edwards and D. B. Strohm. Modern Packaging *19*, 157–9, 190 (Oct. 1945). A method is described for measuring the permeability of materials to carbon dioxide. It is an adaptation of a procedure widely used for measuring the permeability to moisture vapor and uses some of the same equipment. This method permits the measurement of thin films and sheets under a variety of test conditions and permits some interesting comparisons, particularly as to the effect of the moisture content of plastic films on their permeability to carbon dioxide. With some materials this effect is small, but with other materials it is very substantial.

DETERMINATION OF THE SATURATION WATER CONTENT OF PROTEIN PLASTICS. E. F. Mellon. Ind. Eng. Chem. Anal. Ed. *17*, 743 (Nov. 1945). A procedure for determining the saturation water content of plastics is described. The method appears satisfactory for cellulose acetate, urea-formaldehyde and melamine-formaldehyde plastics. Phenolic and ethyl cellulose plastics approach saturation slowly.

OVEN FOR MEASUREMENT OF VOLATILITY OF PLASTICIZERS IN POLYVINYL CHLORIDE AND CHLORIDE-ACETATE COPOLYMER COMPOSITIONS. D. K. Rider and J. K. Sumner. Ind. Eng. Chem. Anal. Ed. *17*, 730–3 (Nov. 1945). A new oven for use in the measurement of volatility of plasticizers in polyvinyl chloride and chloride-acetate copolymer compounds is described. Using this oven, a reliable test method was developed which is capable of distinguishing between various plasticizers on the basis of small differences in volatility.

REVIEW OF ADHESION TESTS. J. J. Bikerman. Printing and Allied Trades Research Assoc., Packaging Bull. No. *2*, 23 pp. (1945). The strength of adhesive bonds and the tackiness and setting times of adhesives are reviewed.

METHOD FOR DETERMINING THE INSTANTANEOUS HARDNESS OF PLASTIC SUBSTANCES. A. Cameron. Trans. Faraday Soc. *41*, 583–6 (Oct. 1945). A modification of a method due to Martel is described that enables the instantaneous hardness of plastic substances to be measured. A weighted cone is dropped from various heights onto the surface of the plastic. The hardness is given by the energy of impact divided by the volume displaced, which has the dimensions of a stress. This is shown to be substantially independent of the height of drop and weight of the cone. The chief advantage of the method is that the measurements are practically instantaneous and so well within Maxwell's relaxation time. Errors due to the plastic flow of the system are therefore avoided.

Synthetic Rubber

VULCANIZATION OF RUBBER WITH PHENOL-FORMALDEHYDE DERIVATIVES. S. van der Meer. Rec. Trav. Chim. *63*, 147–56 (1944); Chem. Abstracts *39*, 3961 (Sept. 10, 1945). The vulcanization of rubber with phenol-formaldehyde derivatives was investigated. The results of a large number of experiments are reported and a mechanism to explain the reaction of rubber with these resins is advanced.

THE DETERMINATION OF PEROXIDES IN SYNTHETIC RUBBERS. R. F. Robey and H. K. Wiese. Ind. Eng. Chem. Anal. Ed. *17*, 425–6 (July 1945). The ferrous thiocyanate colorimetric method is applicable to the determination of active oxygen in commercial synthetic rubbers if the reagent is made up in a mixed solvent comprising absolute ethanol and chloroform. Antioxidants used in commercial synthetic rubbers do not affect the results.

HEATS AND ENTROPIES OF DILUTION OF NATURAL RUBBER BY VARIOUS LIQUIDS. J. Ferry, G. Gee and L. R. G. Treloar. Trans. Faraday Soc. *41*, 340–50 (June 1945). Calorimetric measurements of the heats of mixing of seven liquids with dihydromyrcene are used to estimate the heats of dilution of rubber by these liquids. Combining the results with free energies calculated from vapor pressure gives entropies of dilution which show significant deviations from the statistical theory. A thermodynamic study of rubber and methyl alcohol shows similar but larger deviations. The statistical thermodynamic theory of polymer solutions is confirmed as a valid and useful first approximation. In general, the free energy of dilution can be expressed with considerable accuracy as the difference between the "apparent heat of dilution," which is proportional to the square of the volume fraction of the polymer, and the temperature multiplied by the entropy of dilution calculated for random mixing. The identification of these two terms as the time heat and entropy of dilution is not generally correct, both being subject to considerable variations arising from the existence of order in the components or in the mixture. These variations, whose effects on the free energy nearly cancel, are in the direction to be expected from Orr's analysis of the effect of a finite heat of mixing, but may be considerably larger. The present theory fails most seriously in the estimation of 1) two-phase equilibria, and 2) the temperature coefficient of free energy.

ALKYD RESINS IN THE RUBBER INDUSTRY. G. Leffingwell and M. A. Lesser. Rubber Age *58*, 66–8 (Oct. 1945). Applications involving alkyd resins compounded with rubber are reviewed. Alkyds are compounded with natural rubber, alkyd polysulfide and polychlorobutadiene to produce gas-retaining coatings. Alkyd resins are compounded with chlorinated rubber to produce enamels. Mixtures of alkyds and various types of rubbers are also used for coating paper and textiles. Alkyd resins are used with rubbers as tackifiers, extenders, anti-scorching agents and plasticizers.

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U. S. Plastics Patents

Copies of these patents are available from the U. S. Patent Office, Washington, D. C., at 10 cents each.

POLYVINYL CHLORIDE. E. R. Meincke (to American Cyanamid Co.). U. S. 2,386,405, Oct. 9. Polyvinyl chloride plasticized with a mixed ester of a polyhydroxy alcohol and 3,6-endomethylene-delta-4,5-tetrahydrophthalic acid.

POLYESTER - AMIDES. C. J. Frosch (to Bell Telephone Laboratories, Inc.). U. S. 2,386,454, Oct. 9. A body comprising a microcrystalline linear polymer having permanent molecular orientation produced by the application of directional stresses to the reaction product produced by heating a monoalkylolamine and an aliphatic dicarboxylic acid.

INSULATOR. J. F. Hyde (to Corning Glass Works). U. S. 2,386,466, Oct. 9. A metallic conductor which is covered with an insulating layer comprising a resinous organo-silicon oxide.

ORGANO-SILICON POLYMERS. J. F. Hyde (to Corning Glass Works). U. S. 2,386,467, Oct. 9. The viscosity of a polymeric liquid organo-silicon oxide is increased by passing oxygen through the liquid at a temperature between 200 and 300° C. until an increase in viscosity is obtained.

SAFETY GLASS. G. Barsky (to Wecoline Products, Inc.). U. S. 2,386,534, Oct. 9. Plasticizers for safety glass interlayers comprising halogenated triethylene glycol esters of unsaturated fatty acids.

LAMINATED MOLDED STRUCTURES. E. L. Vidal (to Vidal Corp.). U. S. 2,386,578, Oct. 9. A forming device for curved laminated structures comprising a rigid support and a flexible member capable of being pressed by fluid pressure against deformable material placed between the rigid and flexible members.

DRAWING SURFACE. G. F. Nadeau, E. H. Hilborn and C. S. Hunter (to Eastman Kodak Co.). U. S. 2,386,626, Oct. 9. An improved drawing surface is prepared by coating a transparent cellulose acetate sheet with a lacquer composed of ground glass, cellulose acetate, gelatin, sodium sulfate, water, methyl Cellosolve, acetone, methanol, acetic acid.

DISPERSION. C. F. Flint, R. B. Fisher and F. Clarke (to Imperial Chemical Industries, Ltd.). U. S. 2,386,674, Oct. 9. An aqueous dispersion of polymers of ethylene and isobutylene.

MOLDING. H. J. Lynch. U. S. 2,386,697, Oct. 9. An apparatus for injection molding of various types of plastic materials.

COATED PAPER. F. H. Manchester (to Wingfoot Corp.). U. S. 2,386,700, Oct. 9. Paper coated with a mixture comprising rubber hydrochloride and a benzene-soluble copolymer of vinyl chloride and vinylidene chloride and containing rubber hydrochloride.

PLASTIC. F. J. Myers (to Resinous Products and Chemical Co.). U. S. 2,386,744, Oct. 9. An infusible, heat non-convertible, homogeneous, plastic mass is prepared by mechanically working together an organic solvent-soluble non-oil-modified condensate of a saturated aliphatic dicarboxylic acid having at least six carbon atoms and a polyhydric alcohol and a hydrocarbon-soluble condensate of a carbamide or aminotriazine formaldehyde and an aliphatic alcohol.

EXTRUSION DEVICE. H. F. Eisengren (to Glidden Co.). U. S. 2,386,782, Oct. 16. An extrusion device for moldable material.

COATING METHOD. F. R. Seavey (to Olin Industries, Inc.). U. S. 2,386,818, Oct. 16. A method for coating an elongated body with a viscous plastic material.

SURFACING. R. E. Davis (to Kalman Floor Co., Inc.). U. S. 2,386,843, Oct. 16. A device for surfacing plastic materials.

MATERIALS OPAQUE TO ULTRAVIOLET. W. Horback (to Celanese Corp. of America). U. S. 2,386,855, Oct. 16. Articles transparent to visible light, but opaque to ultraviolet comprising a cellulose derivative having incorporated therein fluoranthene or the alkyl or aryl derivatives thereof.

MOLDING. H. F. MacMillin (to Hydraulic Development Corp.). U. S. 2,386,966, Oct. 16. A device for injection molding with the aid of high frequency electrostatic heating.

THERMOPLASTIC. G. D. Martin (to Monsanto Chemical Co.). U. S. 2,386,968, Oct. 16. A thermoplastic with enhanced resistance to swelling is prepared by treating a conjugated butadiene polymer rubber with phosphorous pentachloride or pentabromide to partially halogenate the rubber.

POLYSTYRENE SHEET. J. P. Putnam (to Reece Button Hole Machine Co.). U. S. 2,386,976, Oct. 16. A thin sheet of polystyrene is permanently flattened by subjecting to a temperature of 170° F. while placed between plates sufficiently light in weight as to prevent cold flow and causing the sheet to cool to room temperature while between plates.

ICE TRAY GRID. T. W. Rundell (to Philco Radio and Television Corp.). U. S. 2,386,979, Oct. 16. An ice tray grid composed of plastic material.

LAMINATED SAFETY GLASS. J. D. Ryan (to Libbey-Owens-Ford Glass Co.). U. S. 2,386,980, Oct. 16. A laminated glass-plastic sandwich is safeguarded against blow-ins during autoclaving by subjecting to preliminary pressing, applying an oil-impermeable lacquer around the edges, autoclaving and finally removing the lacquer.

SPONGY MATERIAL. V. F. Wigal (to B. F. Goodrich Co.). U. S. 2,386,995, Oct. 16. A synthetic thermoplastic spongy material is prepared by forming pores in a plasticized high molecular weight linear polymer such as vinyl chloride.

ALLYL ESTER RESINS. D. E. Adelson and H. Dannenberg (to Shell Development Co.). U. S. 2,386,999, Oct. 16. A resin is prepared by heating between 100 and 250° C. a fusible polymer of diallyl diglycolate under sufficient pressure to render the polymer mass coherent.

MOLDING. S. Milano (to Maryland Plastics, Inc.). U. S. 2,387,034, Oct. 16. A method for molding buttons from plastic material.

RESINS. F. P. Otto and O. M. Reiff (to Socony-Vacuum Oil Co., Inc.). U. S. 2,387,037, Oct. 16. A hard resinous composition formed by reacting diphenyl ether with a chlorinated petroleum wax in the presence of a Friedel-Crafts catalyst, and finally decolorizing and hydrogenating with zinc and water.

MODIFIED SHELLAC. H. H. Bassford, Jr. (to U. S. Shellac Importers Association, Inc.). U. S. 2,387,049, Oct. 16. A resin prepared by heating a mixture of shellac and urea at a temperature of 140 to 180° C.

POLYVINYL CHLORIDE. F. A. Bent (to Shell Development Co.). U. S. 2,387,111, Oct. 16. A vinyl halide resin plasticized with dicyclopentyl adipate.

SHATTERPROOF PLASTIC. B. Andersen and E. Schweizer (to Celanese Corp. of America). U. S. 2,387,227,

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Oct. 23. Shaped plastic composite material having high resistance to bullet impact is prepared by molding into a three-dimensional shape a composite material comprising a layer of soft plastic material having embedded therein an open mesh wire fabric and a harder plastic material.

OIL RESIN. W. C. Ault (to United Gas Improvement Co.). U. S. 2,387,237, Oct. 23. A hydrocarbon resin is prepared from a hydrocarbon oil separated from petroleum tar by heating in the presence of a catalyst.

A PHENOL - FORMALDEHYDE RESIN. F. J. Groten (to American Cyanamid Co.). U. S. 2,387,256, Oct. 23. A process for catalyzing the cure of a phenol-formaldehyde resin comprising heating with a fusible melamine-formaldehyde resin.

ADHESIVE. C. A. Vana (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,387,367, Oct. 23. An adhesive and coating composition consisting in a sodium silicate base adhesive having dispersed therein a homogeneous mixture of a plasticized coumarone-indene resin.

SHELLAC DERIVATIVE. W. H. Gardner and H. H. Bassford, Jr. (to U. S. Shellac Importers Association, Inc.). U. S. 2,387,388, Oct. 23. A shellac product prepared by reacting shellac with ethylene glycol and further reacting with a high molecular weight polyglycol.

NITROCELLULOSE. W. D. Hedges, J. C. Lowman and T. J. Kerr (to Columbus Coated Fabrics Corp.). U. S. 2,387,-393,-4-5-6, Oct. 23. A plasticizer for cellulose nitrate coatings comprising heat reacting a mixture of castor oil, maleic anhydride, and diethylene glycol and applications for said coating film.

COATING. W. A. Waldie (to New Wrinkle, Inc.). U. S. 2,387,424, Oct. 23. A wrinkle varnish coating which comprises extracting a non-conjugated drying oil with a selective solvent such as furfural, furfural acetone, furfuryl alcohol or tetrahydrofurfuryl alcohol, separating the extract mixture, reacting the remaining oil with resin, adding drier and extract, and finally heat treating at 200 to 400° F. to produce the coating.

THERMOPLASTIC. P. M. Downey (to Monsanto Chemical Co.). U. S. 2,387,502, Oct. 23. A plastic material comprising an admixture of a rubber-like polymer such as butadiene-1,3, 2-chlorobutadiene-1,3, a copolymer of butadiene-1,3 and styrene or acrylonitrile and a rubber-like vulcanizable oil resistant plastic obtained by heating a rubber with a crude aryl phosphine halide.

COPOLYMERS. C. A. Kraus (to Jasco, Inc.). U. S. 2,387,517, Oct. 23. A compound having a methylene group is copolymerized with an unsaturated hydrocarbon by contacting a mixture in the liquid phase at a low temperature with an organo-metallic halide.

POLYMER. I. E. Lightbown and W. J. Sparks (to Jasco, Inc.). U. S. 2,387,518, Oct. 23. A stable polymer comprising a high molecular weight linear polymeric hydrocarbon and as stabilizer a thiocarboxylic compound.

THERMOPLASTIC. G. D. Martin (to Monsanto Chemical Co.). U. S. 2,387,521, Oct. 23. A thermoplastic material is prepared by mixing a rubber with an organic phosphine halide and an aromatic polynuclear hydrocarbon and heating in the presence of a modifying agent.

POLYMERS. W. W. Prichard (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,387,530, Oct. 23. The properties of linear, active hydrogen containing polymers containing carbon amide and carboxylic acid ester groups are modified by reacting with the cyclic anhydride of an organic dicarboxylic acid having an acyclic chain.

COLLAPSIBLE FLUID BLADDER. A. N. Spanel. U. S. 2,387,539, Oct. 23. A collapsible fluid bladder which possesses a flexible thermoplastic resinous side wall.

RESIN. G. Widmer and W. Fisch (to Ciba Products Corp.). U. S. 2,387,-547, Oct. 23. The reaction products of melamine with a formaldehyde-yielding compound such as methylol-melamine crystals.

THERMOPLASTIC. J. Custers (to Alien Property Custodian). U. S. 2,387,-566, Oct. 23. A device and method for adhering plies of thermoplastic materials.

SWEATBAND. F. De Feo. U. S. 2,387,567, Oct. 23. A sweatband composed of thermoplastic material.

RESINS. H. Fikentscher and R. Roehm (to Alien Property Custodian). U. S. 2,387,571, Oct. 23. Heat-stable polymers comprising solid high polymer halogen-containing substances such as chlorinated rubber, polyvinyl chloride, chlorinated polyvinyl chloride and chlorinated vinyl chloride, an alkali carbonate and an aliphatic or aromatic higher alcohol.

COATING. A. L. Ward (to United Gas Improvement Co.). U. S. 2,387,626, Oct. 23. A formed film-coated article shaped by deformation of a metallic body coated with a dried film of a wax and a benzene-soluble polymer such as cyclopentadiene alone or mixed with methyl cyclopentadiene.

PLASTIC. W. H. Holst (to Atlas Powder Co.). U. S. 2,387,662, Oct. 23. A safety glass interlayer comprising polyvinyl butyral resin plasticized with the tributylidene of sorbitol.

CLOSURE. C. M. Langkammerer (to Remington Arms Co., Inc.). U. S. 2,387,665, Oct. 23. A closure for shot shells comprising a composite plug which consists of a combination of ethyl cellulose and weak paper.

POLYETHYLENE. W. L. Alderson, Jr. (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,387,730, Oct. 30. Porous ethylene polymers are prepared by heating the polymer to its melting point under 545 p.s.i. pressure with a soluble gas, reducing the pressure and finally cooling to solidify.

POLYETHYLENE. W. E. Hanford (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,387,755, Oct. 30. Hydrogenated polyethylene is prepared by passing a gaseous mixture of ethylene and hydrogen at 40° C. and 50 atm. pressure in the presence of a peroxy compound and oxygen into a high pressure reaction zone.

HOT-MELT COATINGS. M. Salo and H. F. Vivian (to Eastman Kodak Co.). U. S. 2,387,773-4, Oct. 30. Hot-melt coating compositions comprising cellulose acetate butyrate, an antioxidant and a mixture of dibutyl sebacate and butyl stearate or di-3-ethyl hexyl phthalate and butyl stearate.

OLEFIN POLYMERS. R. M. Thomas and H. C. Reynolds, Jr. (to Standard Oil Development Co.). U. S. 2,387,784, Oct. 30. Normal olefins are polymerized by dissolving a Friedel-Crafts catalyst in an alkyl halide, cooling the olefin to −10° C., mixing the two and allowing the polymerization to continue for a substantial time.

CELLULOSE ACETATE YARN. R. M. Hoffman (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,387,791, Oct. 30. Cellulose acetate yarns are prepared by heating an acetone solution of cellulose acetate to 50 to 70° C. and extruding through circular orifices into an atmosphere heated to 85 to 115° C.

POLYVINYL ACETALS. H. D. Cogan and R. W. Quarles (to Carbide and Carbon Chemicals Corp.). U. S. 2,387,-831, Oct. 30. A plastic composition containing a water-insoluble resinous partial acetal of polyvinyl alcohol and an aliphatic monoaldehyde combined with an aliphatic dicarbonylic compound such as glyoxal or methyl glyoxal.

POLYVINYL ACETALS. J. Dahle (to Pro-Phy-Lac-Tic Brush Co.). U. S. 2,387,833, Oct. 30. A water-soluble polyvinyl alcohol is insolubilized by treating with a solution of sulfuric acid and methanol, drying and heating at reflux in the presence of a catalyst and an aldehyde and dissolved in a hydrocarbon.

VINYL RESINS. R. M. Goepp, Jr. (to Atlas Powder Co.). U. S. 2,387,841, Oct. 30. A lamp changer comprising a pole and a pair selected from the group

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polyvinyl chloride, polyvinyl chloride-acetate and polyvinyl butyral and, as plasticizer, a hexide diester.

DIOLEFIN RESINS. H. L. Gerhart (to Pittsburgh Plate Glass Co.). U. S. 2,387,895, Oct. 30. A synthetic resin is prepared by continuously flowing a mixture of a diene hydrocarbon and an unsaturated glyceride oil at a pressure of 60 to 120 p.s.i. through a tube which is then heated to 200 to 450° C. until a polymer is formed.

UNSATURATED POLYESTERS. I. E. Muskat and F. Strain (to Pittsburgh Plate Glass Co.). U. S. 2,387,931-2-3-4, Oct. 30. Polyesters of aliphatic and aromatic acids and unsaturated alcohols.

CEMENT. H. Zimmerman. U. S. 2,387,967, Oct. 30. A tabbing cement having as a base a water emulsion of polyvinyl acetate and a plasticizer to which is added an agent, which increases the tenacity of the film, comprising a polyhydroxy alcohol such as glycol or glycerol.

POLYAMIDES. C. J. Frosch (to Bell Telephone Laboratories, Inc.). U. S. 2,388,035, Oct. 30. A linear polyamide identical with that prepared by condensing polymethylene dicarboxylic acid and a mixture of a diprimary polymethylene diamine, a polymethylene diamine having an alkyl substituent and a polymethylene diamine having an alkyl substituent on each of its amino groups.

CONDENSATES. J. B. Rust (to Montclair Research Corp.). U. S. 2,388,086, Oct. 30. A resinous condensate is prepared by heating glyoxal and an aqueous solution of an acyclic ketone having a reactive methylene group, any oxygen present in the ketone being in the form of the carbonyl group.

ETHYLENE POLYMERS. C. H. Greenewalt (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,388,138, Oct. 30. In the polymerization of ethylene, the process comprising compressing the ethylene to between 20 and 150 atm., refrigerating the ethylene under this pressure to between −35 and 5° C. and increasing to polymerization pressures of 800 to 3000 atm.

AMINOTRIAZINE RESINS. R. R. Harris (to American Cyanamid Co.). U. S. 2,388,143, Oct. 30. A hardenable aminotriazine-aldehyde condensate intimately mixed with a curing catalyst such as ammonium silicofluoride and ammonium borofluoride.

KNITTED GOODS. F. Headon. U. S. 2,388,144, Oct. 30. A non-run knitted fabric of a yarn including thermoplastic material.

ETHYLENE POLYMERS. N. W. Krase (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,388,160, Oct. 30. In the fractionation of solid ethylene polymers the process is effected by controlling heat and pressure.

ETHYLENE POLYMERS. A. McAlevy, D. E. Strain and F. S. Chance (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,388,169, Oct. 30. A process for curing an interpolymer of ethylene and an organic monocarboxylic acid ester of vinyl alcohol comprising heating a mixture of sulfur and the interpolymer.

POLYETHYLENE. M. D. Peterson (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,388,178, Oct. 30. Ethylene is polymerized by subjecting to elevated temperatures and pressures in the presence of free oxygen, water and an alkali.

LAMINATES. K. E. Ripper (to American Cyanamid Co.). U. S. 2,388,184, Oct. 30. A rigid laminate comprising layers of cellulosic fibers, glass cloth and a synthetic thermosetting amino resin.

CELLULOSE ETHER. H. L. Boulton and A. B. Savage (to Dow Chemical Co.). U. S. 2,388,206, Oct. 30. A composition including a cellulose ether, a plasticizer and an organic carboxylic acid ester of a polyglycol.

ETHYLENE POLYMERS. R. E. Brooks, M. D. Peterson and A. G. Weber (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,388,225, Oct. 30. In the polymerization of ethylene, the step which comprises reacting in an aqueous alkaline medium in the presence of an alkali persulfate and a buffering agent.

RESINS. P. I. Bowman and H. Burrell (to Heyden Chemical Corp.). U. S. 2,388,235, Nov. 6. An anion exchanging resin comprising the reaction product of melamine, diethylenetriamine and formaldehyde solution, which has been gelled with sodium hydroxide and set with a strong acid.

ACETAL POLYMERS. J. Dahle (to Pro-Phy-Lac-Tic Brush Co.). U. S. 2,388,238, Nov. 6. A solid polyvinyl alcohol is insolubilized by reacting a mixture of an alkyl alcohol, an aldehyde and an acetalization catalyst, and treating the solid polyvinyl alcohol in the reaction mixture.

POLYAMIDES. R. W. Moncrieff and E. W. Wheatley (to Celanese Corp. of America). U. S. 2,388,278, Nov. 6. The solid polymerizate of hexamethylenediamine and adipic acid is separated from the reaction mixture by dissolving in formic acid, filtering and precipitating with an aqueous solution of an organic solvent which is a non-solvent for the polymer.

MOLDABLE MATERIAL. P. C. Schroy, J. Grabowski and M. J. Scott (to American Cyanamid Co.). U. S. 2,388,293, Nov. 6. A molding composition comprising a mixture of a fusible melamine-formaldehyde resin and an aniline-shellac-formaldehyde resin.

EXTRUDED PLASTICS. C. E. Slaughter (to Extruded Plastics, Inc.). U. S. 2,388,297, Nov. 6. Composite articles of extended area are prepared from plastic strips by inserting a resin sheet having a beaded edge into an extruded thermoplastic strip having along an edge flexed walls defining a groove, which grips the bead of the first sheet, and finally self welding under heat and pressure.

ALKYD RESIN. W. A. Waldie (to Commonwealth Engineering Co.). U. S. 2,388,301, Nov. 6. Pigmented alkyd resins are prepared by reacting a fatty oil with an alkali to form a soluble soap, mixing with a non-reacting pigment, acidifying to precipitate the oil in the pigment particles, adding to the heat reaction product of a polycarboxylic acid and a polyhydric alcohol and heating to react with the oil.

POLYESTERS. C. J. Frosch (to Bell Telephone Laboratories, Inc.). U. S. 2,388,318, Nov. 6. Polydecamethylene dihydromuconate of sufficiently high molecular weight to allow its being cold-drawn into fibers showing crystalline orientation along the fiber axis.

POLYESTERS. C. S. Fuller (to Bell Telephone Laboratories, Inc.). U. S. 2,388,319, Nov. 6. An infusible, insoluble polymer produced by curing with an organic peroxide, a fusible microcrystalline dihydroxy aliphatic hydrocarbon polyester possessing sufficient crystallinity and linear growth to impart cold-drawing properties.

POLYVINYL ALCOHOL. R. C. Houtz (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,388,325, Nov. 6. Filaments, films, etc., are prepared from polyvinyl alcohol by coagulating in an aqueous solution of ammonium sulfate, the latter being removed by washing with a solution of equal parts of acetone and water.

MOISTUREPROOF SHEET. W. H. Hyden and J. A. Mitchell (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,388,326, Nov. 6. Regenerated cellulose sheet is moistureproofed by coating with a composition having incorporated therein finely divided 1,2-dihydronaphthalene polymer.

BINDER RING. C. E. Emmer (to General Binding Corp.). U. S. 2,388,397, Nov. 6. A partable ring for a ring binder is prepared from a synthetic thermoplastic resin ring by immersing the bottom segment in a plasticizer to render it flexible.

KETONE RESINS. V. E. Haury (to Shell Development Co.). U. S. 2,388,410, Nov. 6. Ketone resins are prepared by heating a substituted cyclohexenone with an aldehyde in the presence of a condensation catalyst.

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Books and Booklets

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Advancing Fronts in Chemistry Vol. I, High Polymers

Edited by Sumner B. Twiss

Published by Reinhold Publishing Corp., 330 W. 42nd St., New York, N. Y., Sept. 1945

Price $4.00 **196 pages**

A series of lectures sponsored by Wayne University, Detroit 1, Mich., under the direction of Neil E. Gordon, chairman of the department of chemistry, is presented here in book form. The program is an attempt to correlate recent and diverse experimental information by presenting the unified concepts of certain phases of the polymerization problem as they are understood and interpreted by various experts in the field.

The first three chapters offer a sound foundation for adequate understanding of the more advanced material contained in the sections which follow. These latter topics include, among others, aspects of the mechanism of addition polymerization, polymerization as a study of reactions of free radicals, effect of chain length on physical properties of cellulose derivatives, nature of the solid state of chain polymers, and a number of varying concepts of textile fibers. The volume is valuable both as a text and a reference manual.

A Short Dictionary of Architecture

by D. Ware and B. Beatty

Published by the Philosophical Library, Inc., 15 E. 40th St., New York, N. Y., 1945

Price $2.75 **109 pages**

This rather complete compilation of architectural terms is designed to aid not only the amateur or professional student of architecture, but also the person who merely runs across these terms in the course of his work. Non-technical in appearance, the book gives brief, easy-to-understand definitions and illustrates the more important principles by means of simple drawings set in close proximity to the definitions.

★ "Ingeneering" (which the publisher Victory Plastics Co., Hudson, Mass., says means putting ingenuity into engineering) is offered to manufacturers in the plastics field through the medium of an elaborate four-color brochure providing conclusive answers to questions of why, how and where to use plastics. The layman who approaches this booklet with no better equipment than a healthy curiosity about plastics will emerge from reading it with at least the basic principles well in mind. He will, for instance, know a thermosetting material from a thermoplastic one, have a general idea of what is involved in the various molding, casting and laminating processes and know some of the limitations and possibilities of plastic materials.

★ B. F. Goodrich Co., Akron 18, Ohio, has prepared a booklet on the present and potential applications of Koroseal including films, luggage, protective wear, screens, weatherproof furniture. Colored illustrations show many of these products.

★ In a two-color folder entitled "Ten Heads Are Better Than One," Monsanto Chemical Co., Springfield 2, Mass., introduces its Plastics Technical Council of ten men, which will consider, free of charge, all types of plastic problems and offer expert and unbiased advice.

★ "Plastics, the Story of an Industry" as prepared under the direction of the Committee on Plastics Education of the Society of the Plastics Industry, Inc., New York 17, N. Y., is a compact and informative illustrated booklet. A glance over the topics covered show its completeness: history and development, impetus furnished by the war, make-up of the industry, plastics—what they are, basic methods of forming plastics, classification and characteristics of materials, plastics and the future, employment opportunities, brochure shows various molding methods. educational facilities, and trade papers.

★ A 30-page illustrated pocket-size booklet prepared by Clemson Bros., Inc., Middletown, N. Y., features selection of the proper blades for cutting various metals, causes and cures of common blade difficulties and hints on cutting procedure.

★ Basic theory, principles and applications of x-ray diffraction are covered in a booklet released by North American Philips Co., Inc., New York 17, N. Y. Divided into three articles, the discussion takes up basic principles and theory, constitution of matter and application of x-ray diffraction.

★ "Diamonds at Work," published by Anton Smit & Co., Inc., New York 19, N. Y., outlines the ordinary uses of the industrial diamond, and presents, in brief, the history of diamond mining. Included in the booklet are diamond characteristics and classifications, diamond truing tools, instructions for ordering, diamond wire drawing dies and diamond powders.

★ Spray nozzles for water cooling, air conditioning, color sprays, lubricating oil sprays and other industrial uses are illustrated in Bulletin N-616 released by Yarnall-Waring Co., Philadelphia 18, Pa.

★ Chemaco Corp., Berkeley Heights, N. J., has prepared an informative and interesting two-color booklet which discusses cellulose acetate, ethyl cellulose, polystyrene and vinyl compounds—the four types of molding materials in which the company specializes. In addition to summing up properties and applications, the brochure describes and illustrates the various molding methods.

★ A new 153-page manual, Edition No. 32, on needle bearings has been brought out by Torrington Co., Torrington, Conn., and South Bend 21, Ind. Pertinent engineering information is supplied on bearings identified as Types LN, DC, NCS, AT and RC. Data include specifications and tolerances, load capacities, design factors, installation, inspection standards.

★ The results of an independent survey on the possibilities of plastics in architecture conducted by Paul Robinson Hunter, West Coast architect, under commission by *Pacific Plastics* Magazine are presented in an eye-pleasing, well organized booklet entitled "Plastics in Building, A Report to Architects, Decorators and Builders." Copiously illustrated, the brochure discusses such subjects as the significance of plastics, their structural uses, plywood and overlays, walls and insulation, transparent and translucent plastics, screening and blinds, flooring, hardware accessories and electric wiring.

★ "Polishing, Buffing and Deburring" is an industrial finishing reference manual issued by Industrial Finishing Div., McAleer Mfg. Co., Rochester, Mich., which tells the user how to choose the correct finishing compositions, how to use them.

★ Now available to molders, designers and major users of plastics is the four-color handbook "Molding with Lumarith" prepared by Celanese Plastics Corp., New York 16, N. Y. A supplement announcing the new product Forticel is included.

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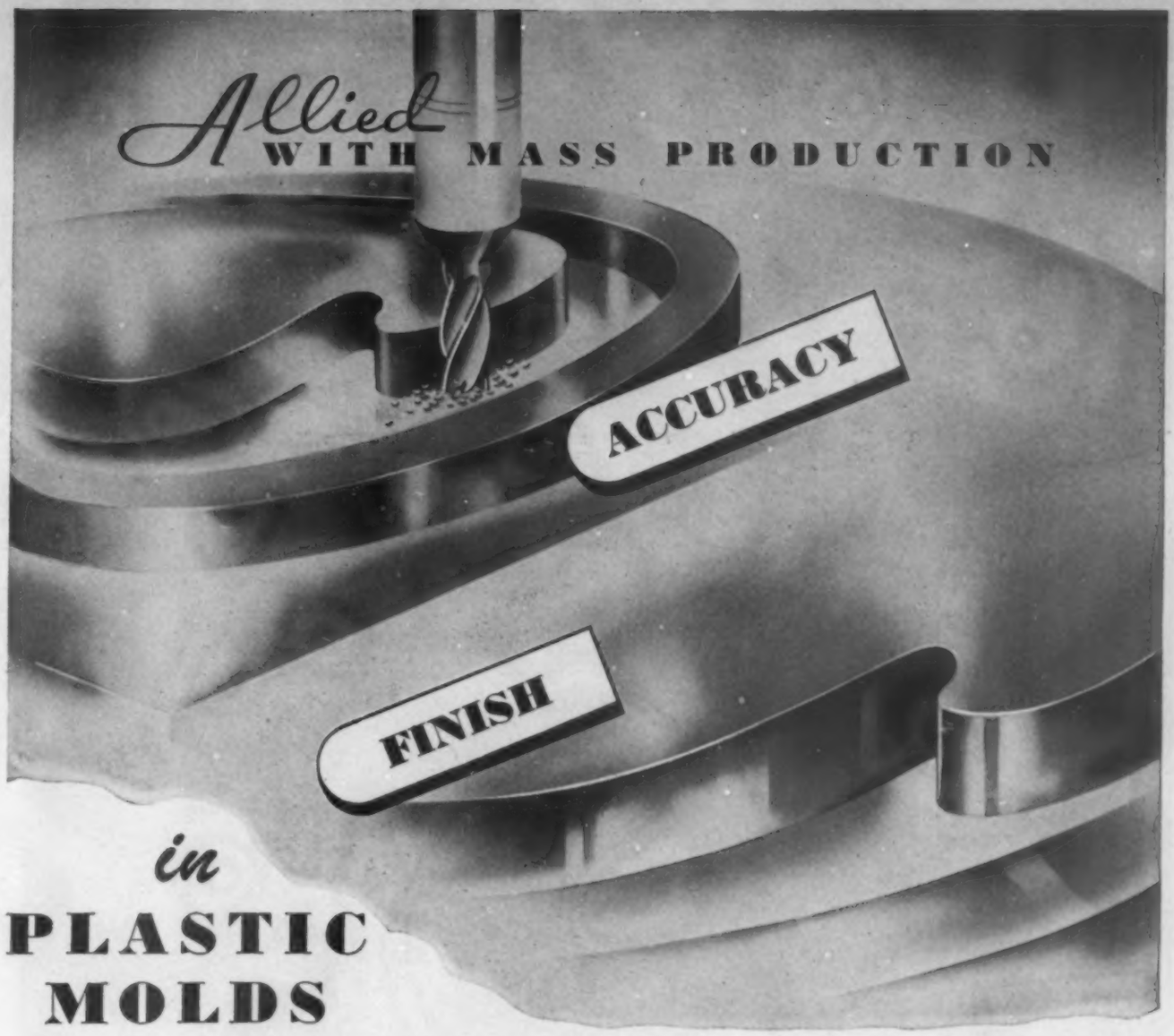

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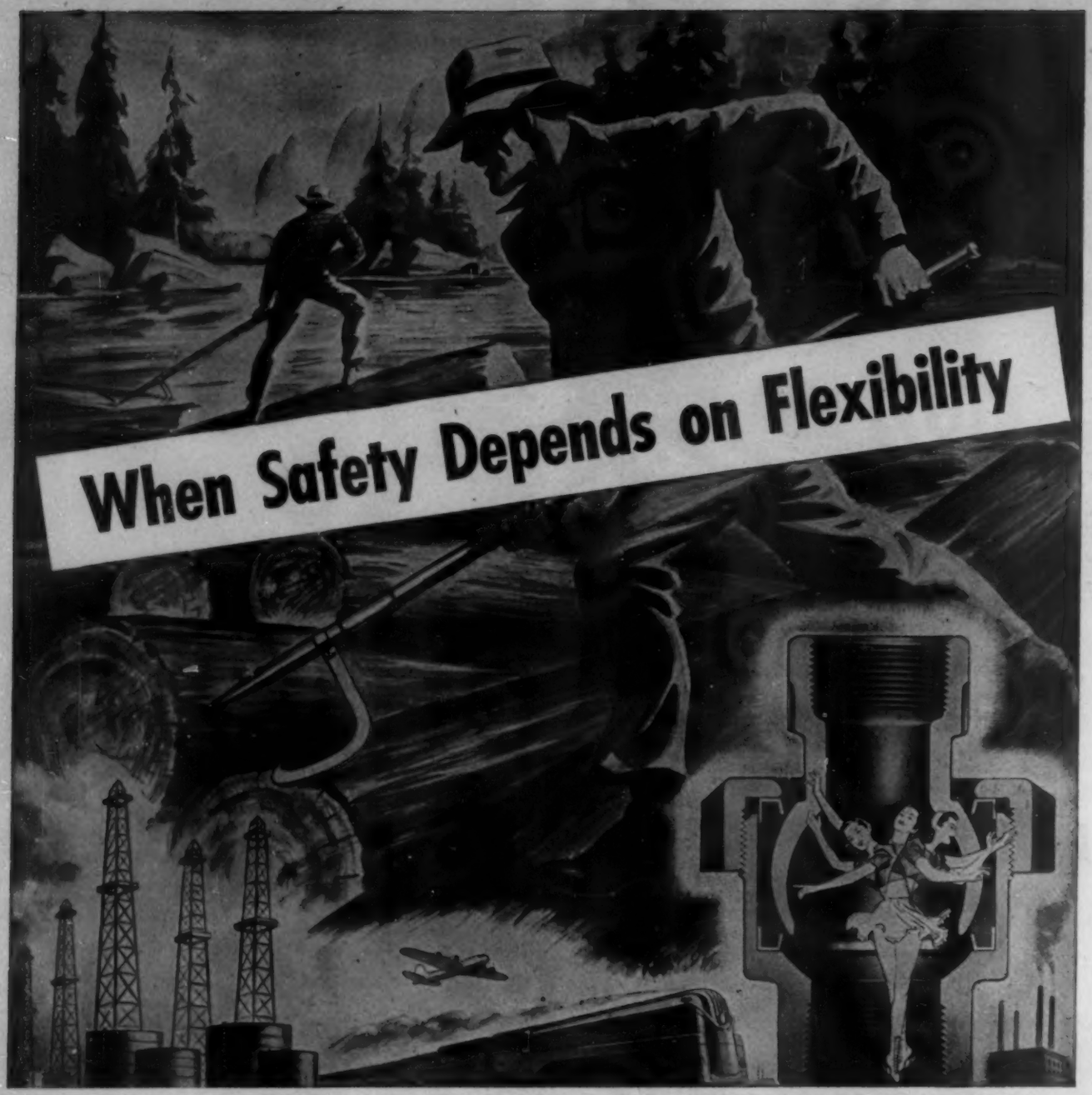

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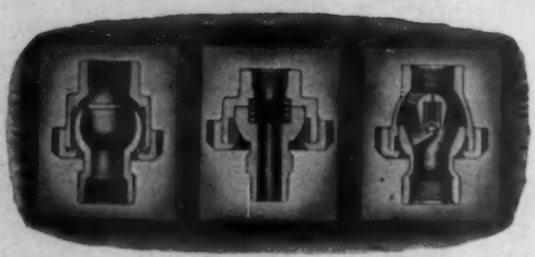

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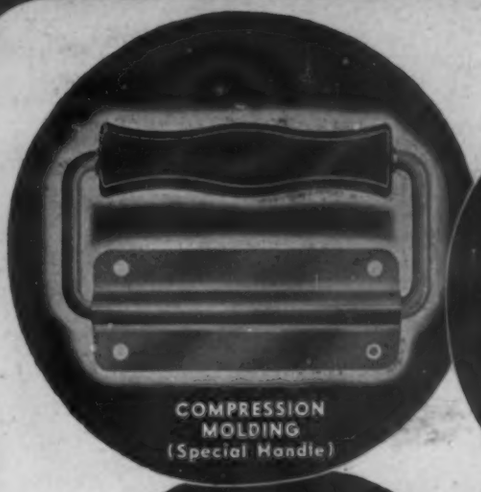

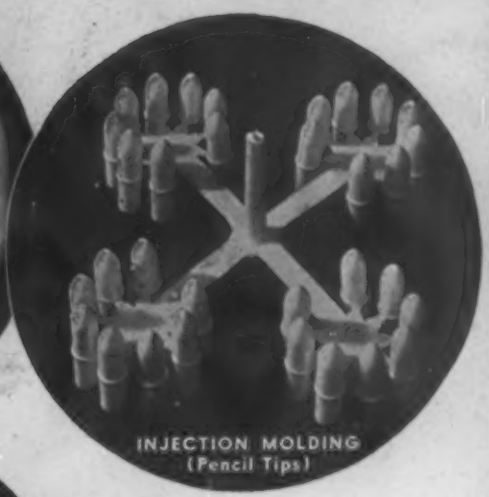

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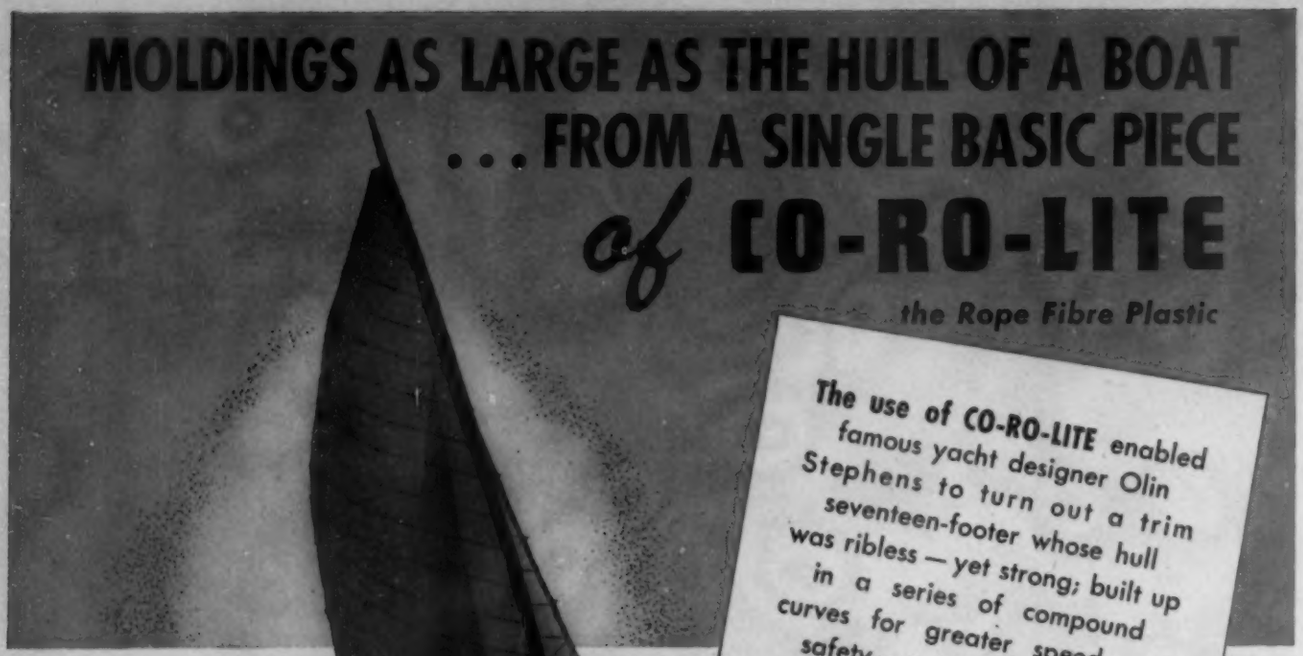

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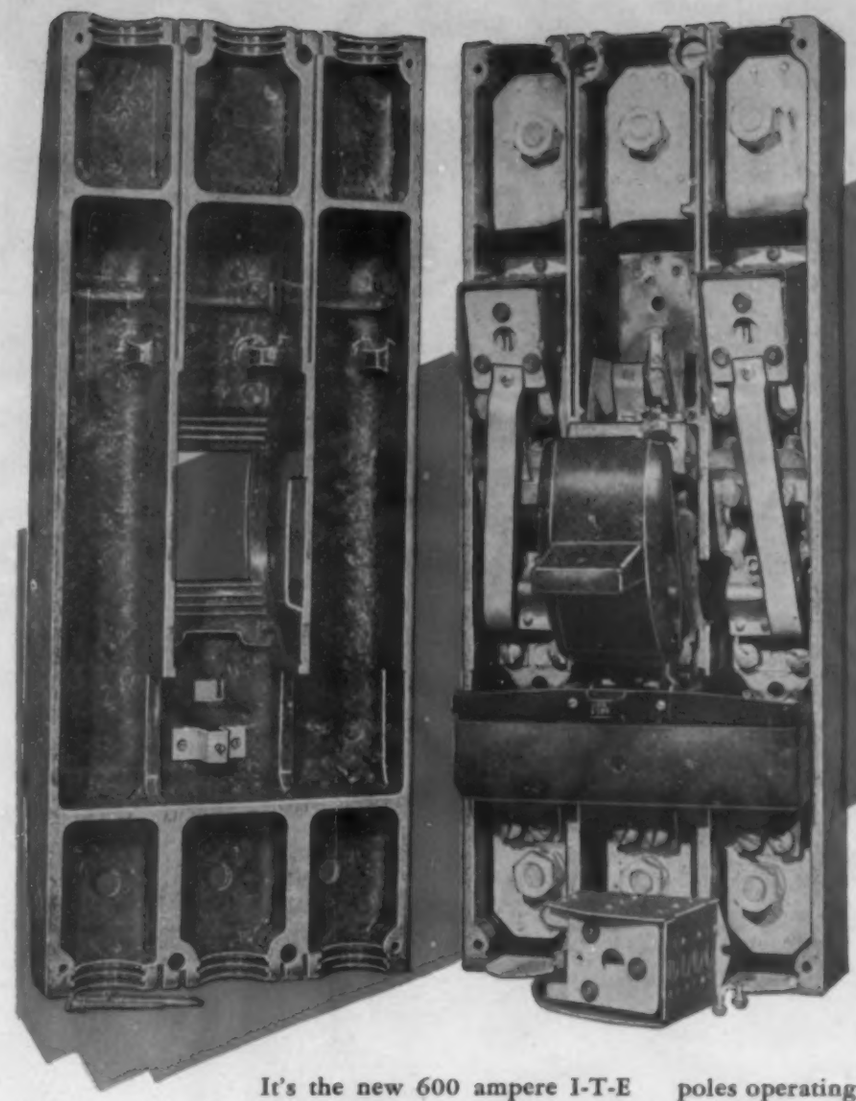

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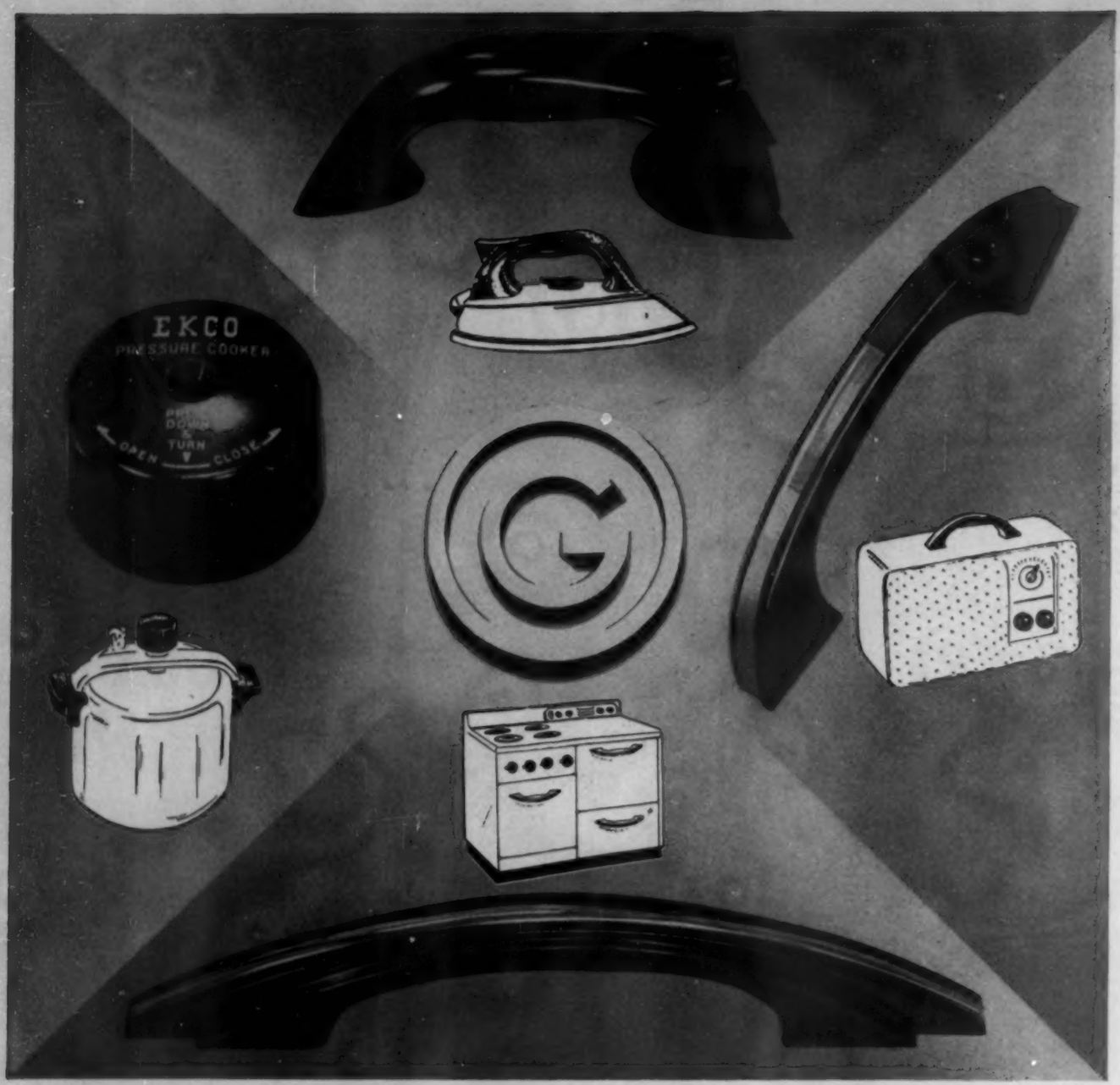

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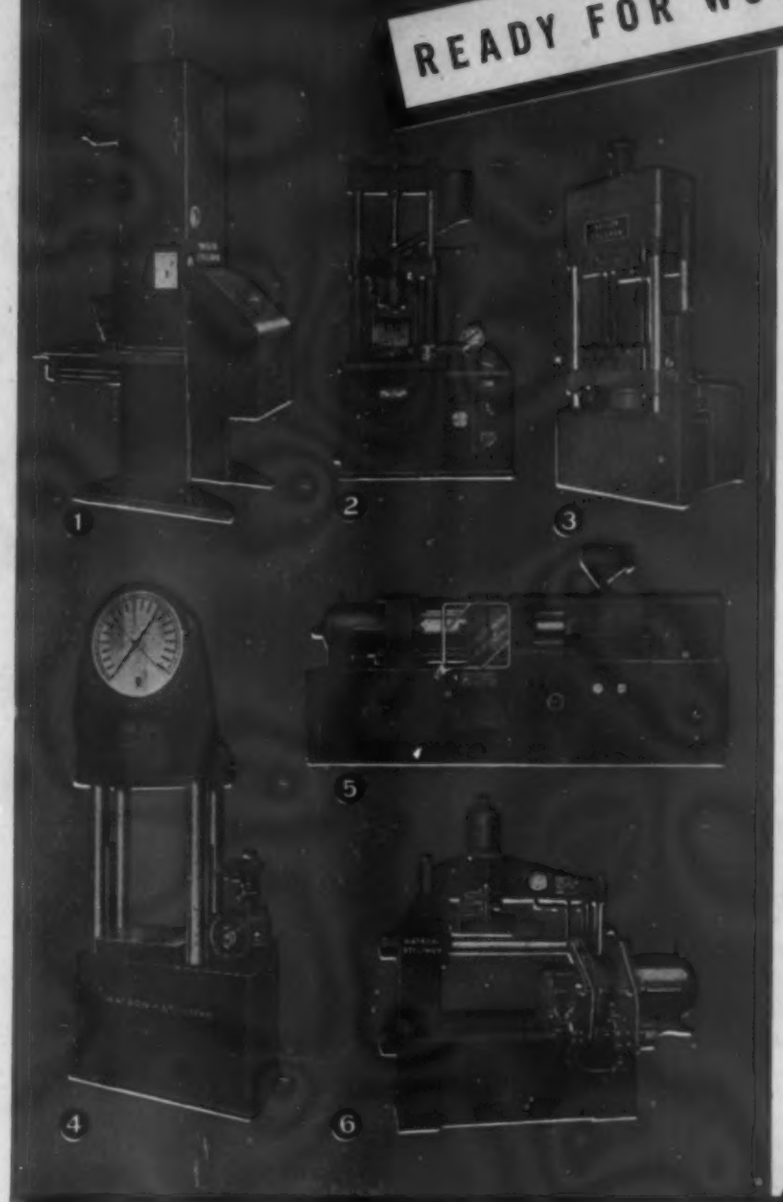

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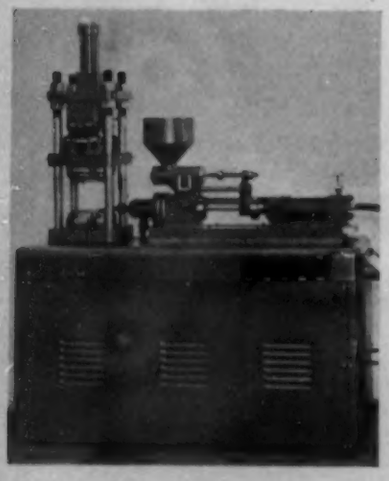
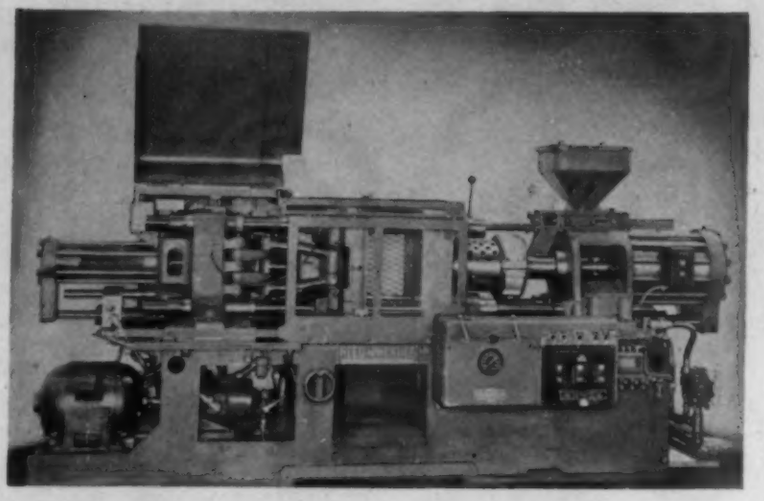
New Machinery and Equipment

★ Preco, Inc., Los Angeles 1, Calif., has announced a new model hydraulic press which produces a 40,000-lb. platen pressure through a two-stage hydraulic pump —a long stroke for quick closure and a short stroke to develop the desired pressure. Improvements in the hydraulic system include use of a cone valve fitted with an "O" ring seal which, according to the announcement, leads to greater efficiency and smoother operation. The press platens, 8 by 8 in., are electrically heated and water cooled; a 750-watt element in each platen provides fast heating up to 600° F. Heavy insulation is used to prevent heat loss.

★ A versatile laboratory size molding machine which can operate as a conventional injection, compression or transfer unit, or as a combination, has been announced by Improved Paper Machinery Corp., Nashua, N. H. This machine is equipped with a vertical clamping unit in conjunction with a horizontal injection unit and contained in the vertical unit is a compression ram which operates up through but independently of the stationary die platen. The mold clamping is accomplished by a hydraulically operated toggle mechanism. All of the features of this company's large injection machine have been designed into this small laboratory



type unit. The clamping pressure is 25 tons and when using a $1^1/_{16}$-in. plunger, the injection pressure on material is 22,000 p.s.i. The capacity is $1^1/_2$ oz. of acetate and 1.2 oz. of styrene. The die opening is adjustable from $5^1/_2$ in. to 9 in., and the die plates can accommodate a mold $8^1/_8$ in. square.



★ Among the features incorporated in the improved 6- and 8-oz. plastic injection molding machines developed by Reed-Prentice Corp., Worcester 4, Mass., are: a double shear link mechanism which is said to increase rigidity and reduce maintenance costs; a one-piece welded steel base; hydraulic piping and valves mounted outside the base for accessibility; new guards which are easily removed for maintenance; electric timing clocks mounted in dust-tight boxes; quick adjustment of clamping and injection units by rack and pinion; transparent plastic window for the safety door, and a plug-in connection for the heater so that it can be readily disconnected. Specifications are listed in table at right.

Size of machine	*6 oz.*	*8 oz.*
Ounces molded per shot	6*	8
*Plasticizing capacity per hr., lb.	45	45
Pressure per sq. in. on material, lb.	20,000	20,000
Size die plates, in.	21 × 25	21 × 25
Space between bars, in.	$11^1/_4$ × $12^1/_4$	$11^1/_4$ × $14^1/_4$
Mold opens, in.	$10^1/_4$	$10^1/_4$
*Max. casting area in mold, sq. in. @ 20,000 p.s.i.	100	100
Mold closing pressure, tons	250	250
Capacity of feed hopper, lb.	50	50
Weight, lb.	13,200	13,400

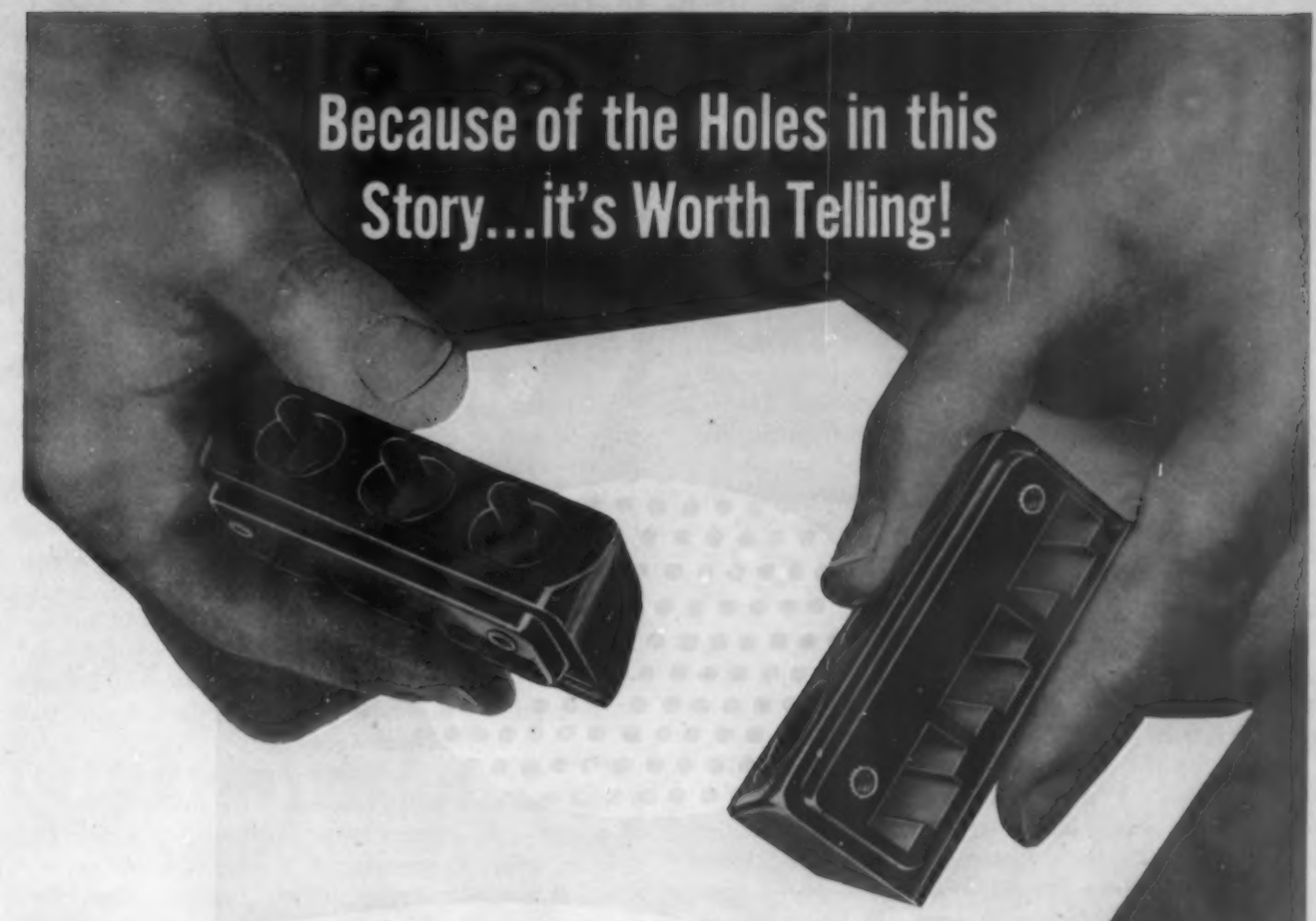
* Dependent on product and mold construction.

★ The Handee Finisher, an abrasive tool produced by Master Specialty Co., Minneapolis, Minn., is well adapted for use by plastic parts finishers, tool and die makers, machinists and model makers, etc., by reason of its light weight and balanced construction. For the same reasons it can be used at high production rates for a number of hours without excessive fatigue. The tool is so designed that 12-in. abrasive strips can be placed on it at one time. When the outside strip becomes worn it can be removed quickly and the next strip secured in place by a twist of a knob.

★ To remove moisture, oil, scale, etc., from compressed air the Swartwout Co., Cleveland, Ohio, has developed a new separator, the Airfuge. The unit employs the same centrifugal principle which its manufacturer has used in steam and oil separators for a number of years and to such good effect that tests have shown the air delivered by the Airfuge to be 99 percent free of contamination. The cleaned air may be taken off horizontally or vertically from pipe-tapped ports in any of the three sizes in which the separator is produced.

★ Acromark Co., Elizabeth 4, N. J., has announced the development of a new cup attachment for assembly in Acromark series 9A and 9AM marking machines which facilitate the marking of half spherical, spherical and cup-shaped plastic and metal parts. The attachment consists of a geared mandrel to fit and hold the part to be marked. The unit is tilted to bring a horizontal marking position directly underneath the mark-(*Please turn to page 218*)

Because of the Holes in this Story...it's Worth Telling!



This is a Terminal Block. The two views of it reveal an alignment of three round, keyed holes molded into one side — and an opposing series of three rectangular, keyed holes molded into the adjacent face. Deep within the piece, these holes meet and form right-angle passages.

The part, of black Phenolic, compression molded with two metal inserts in place, comes out of the die six at a time — each a perfect counterpart — each an example of precision processing.

Much of the piece's success can be attributed directly to the care and accuracy given to the making of the mold. Designed and constructed by Consolidated, the die provides cam-operated, side-core mechanisms that automatically mold the shaped holes into the block.

Of prime importance is the fact that the customer is well pleased — his product well served. As a result of this and countless other Consolidated-solved problems, we invite the opportunity to apply this know-how to any and all custom molding assignments. Should you be planning in plastics, your inquiry will be appreciated.

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A new injection cylinder

THE art and practice of injection molding thermoplastic materials is a comparatively new field. In the early thirties, when thermoplastics were first being worked on a commercial basis, few molding machines were offered on the American market. A molder either built his own machines or imported small manually operated equipment. Since this time American machine builders have taken a lesson from the die casting industry and developed rugged automatic machines with adequate die accommodations and high die locking pressures.

However, the heart of the molding machine—the injection cylinder—has been left too much to trial and error, to carry-overs from original designs. These considerations led the Lester Engineering Company to design an injection cylinder which would plasticize and properly inject the material instead of merely transmitting it from plunger through heated mediums to die.

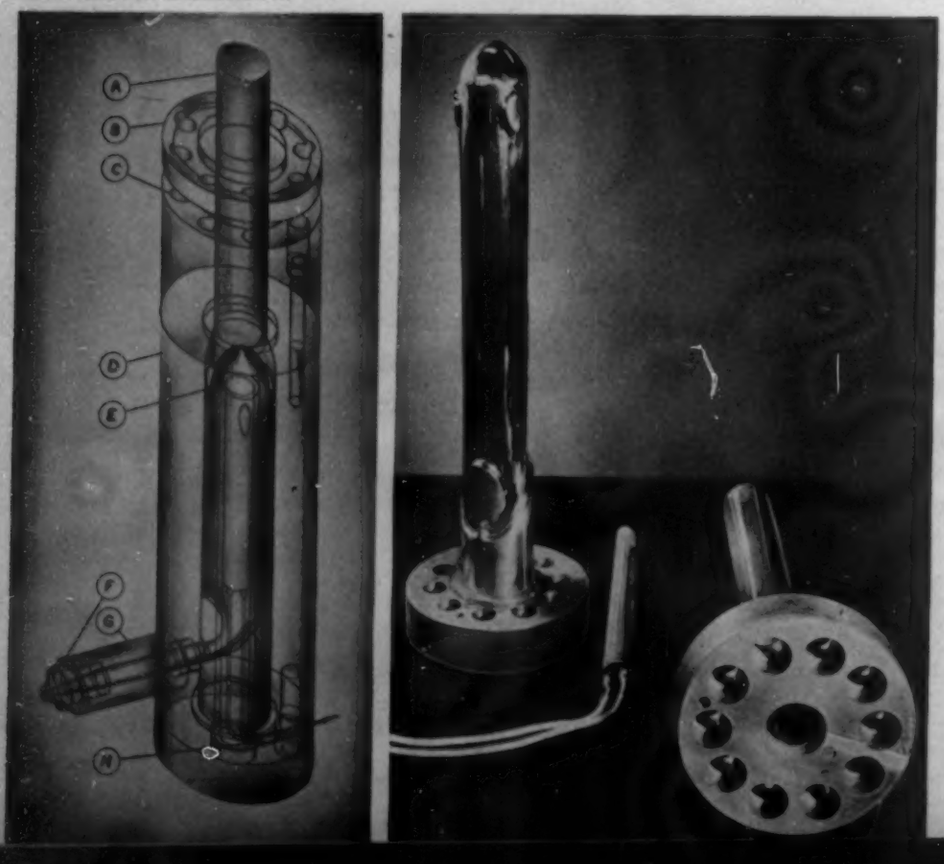
Throughout, the company kept in mind the following four facts: 1) An injection cylinder has been inherently weak due to joints and thin sections in spreader construction. 2) Both excessive pressures and temperatures have been needed to overcome restrictions common in many former designs. 3) Since plastic is a poor conductor of heat, the molding of many jobs has been impaired because of the type of cylinders that were available, the molding cycle being reduced beyond a practical point or the parts being burned and discolored. This point has been proven many times. 4) In producing heavy sectional parts or parts that demand as much accuracy as the art of injection molding has to offer, a molder knows that the lower the temperature he applies to the plastic material, the slighter the shrinkage and the less noticeable the sink marks.

Features of the new cylinder

The following requirements and features were sought when this new injection cylinder project was undertaken: 1) A smooth free passage with no crevices in which materials might lodge and decompose. 2) Even distribution and penetration of the heat. 3) Heat from inside as well as from the outside of cylinder. 4) A gradually diminishing area for the plastic material to flow through. Older types of cylinders in many cases diminished abruptly, creating terrific turbulence and back pressure. 5) Constructionally strong design since a cylinder, no matter how well it operates, is no good unless it keeps working.

The construction of this new injection cylinder shown in phantom view below consists of the following parts: *A*, plunger; *B*, cylinder top; *C*, cylinder top screw; *D*, cylinder body; *E*, spreader; *F*, nozzle; *G*, nozzle extension; *H*, spreader screws. Plastic material is fed into the nickel molybdenum cylinder top *B*. The plunger forces the material past the heated chrome-molybdenum spreader E. The material flows down the ring-like chamber to the two channels on the spreader. From this point the material is gradually directed by means of these channels to the nozzle extension, then to nozzle and die.

PHOTOS, COURTESY LESTER ENGINEERING CO.



This injection cylinder, diagram of which appears at right, is designed to plasticize and properly inject thermoplastic materials instead of merely transmitting them from plunger to die. It incorporates structurally strong parts with smooth passages which gradually diminish in circumference to assist free flow of materials An even distribution of heat inside and outside the cylinder is an additional feature

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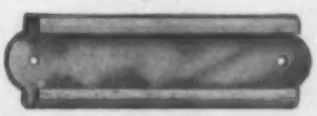

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News of the Industry

ALLAN BROWN

★ J. W. McLaughlin, president of Bakelite Corp., New York 17, N. Y., has announced the election of Allan Brown as vice-president. Mr. Brown is in charge of advertising and public relations.

★ Dave Swedlow has resigned his position as general manager of the Plastics Div. of Shellmar Products Co. to form his own company to be known as Swedlow Plastics Co., Los Angeles 22, Calif. The new firm will engage in low and contact pressure lamination and fabrication of sheet materials such as methyl methacrylate, cellulose, acetate, etc. Mr. Swedlow was formerly president of the Swedlow Aeroplastics Corp., Glendale, Calif., which recently merged with the Shellmar Products Co.

★ General Electric Co.'s Research Laboratory in Schenectady, N. Y., has developed silicone oils that flow at temperatures as low as 121° below zero without congealing. These oils promise to be useful as hydraulic fluids for aircraft systems; in fine instruments and clocks; and as a dielectric fluid in capacitors and transformers.

★ W. Stuart Landes and John R. Hoover have been reelected president and vice-president, respectively, of the Plastic Materials Manufacturers Association, Inc. Frank H. Carman, general manager, and John E. Walker, secretary-treasurer, were also reelected.

★ Reconversion of a former shell producing plant at East Chicago, Ind., for the manufacture of plastic products is being undertaken by Eclipse Moulded Products Co., Milwaukee, Wis. This company, which is the plastic division of General American Transportation Co., is planning operations at this new plant to supplement those of the Milwaukee unit and will include compression, injection, extrusion and perhaps laminating.

★ The plastics division of Monsanto Chemical Co., St. Louis, Mo., has announced a new series of Lustron phosphorescent molding compounds which are said to possess greatly increased after-glow effect. These new materials are expected to find use in a number of various applications such as clocks, instrument dials, auto and aviation dash boards, street markers, etc., and are a direct result of advances made in phosphorescent compounds during the war years. The new 1200 series Lustron materials are available in colors.

★ Celanese Corp. of America has taken over a plant at Belvidere, N. J., for the production of chemicals, plastics and related products. Present plans include an expenditure of more than $10,000,000 and employment of approximately 750 persons in the first phases of operation.

★ A new material called Plastiform has been developed by Duorite Plastic Industries, Culver City, Calif. It is said to produce finished castings in 5 min. and can be reclaimed in much the same manner as metals by melting. It becomes a fluid at a temperature of 240° F. which can be poured, brushed, sprayed or dipped. Molds of almost any type can be used.

★ John A. Benjamin who was formerly sales promotion manager of Continental's paper plant at Van Wert, Ohio, has been appointed acting general manager of the Plastics Div. of Continental Can Co., Inc., Cambridge, Ohio. He replaces J. E. Wolfe, who recently resigned his position with the company.

★ Durez 220V, a modified phenolic oil soluble resin recently announced by Durez Plastics & Chemicals, Inc., N. Tonawanda, N. Y., was formulated to make possible a higher viscosity varnish which retains fast drying time and other desirable properties found in similar resins. It is said to have excellent water and chemical resistance as well as durability and color retention.

★ Terakan 12, a newly improved simulated leather which includes the qualities of workability, eye appeal and flexibility found in genuine leather, is a product of Athol Manuf. Co., Athol, Mass.

★ "Rez-N-Dye" cold-dip dye is a new dyestuff manufactured by Schwartz Chemical Co., New York 23, N. Y. It is a single solution, available in a variety of colors, which imparts a brilliant transparent color to plastics without heat or dilution.

★ Several recent personnel announcements have been made by York Research Corp., New York 7, N. Y. George Lubin, formerly head of the Rigid Plastics Sec. of the Brooklyn Navy Yard, is senior process engineer; Lawrence Smithline has been appointed chief of the Plastics Engineering Division. Two new engineers have been added to the organization: James A. Gale, formerly in charge of the Thermoplastic Sec. of the Brooklyn Navy Yard, and Bernard Jaffe, former development engineer of Panelite Division of St. Regis Paper Co.

★ Boonton Molding Co., New York 17, N. Y., has announced the appointment of Chris J. Groos as vice-president and sales manager.

★ The Dow Chemical Co., Midland, Mich., has announced two new plasticizing resins for use in metal, wood, fabric and paper coatings and with plastics and wax compositions. To be known as 276-V2 and 276-V9, they are the first of a new series of styrene resins developed by this firm.

★ The International Plastic Corp., Morristown, N. J., has announced the appointment of Jules E. Timer as director of trade relations and of Richard W. Girvin as retail sales manager for the Cellulosic Department. Mr. Timer was formerly associated with Sherman Paper Products Corp.; Mr. Girvin with Willmark Research Corp.

★ Casco flexible cement, manufactured by Casein Co. of America, New York 17, N. Y., but discontinued during the war because of the critical shortage of materials, is once again available. The product makes a strong flexible bond between two porous materials or between a porous material and one which is non-porous.

★ W. F. Greiner has been appointed manager of the Decorative Micarta Dept. of U. S. Plywood Corp., New York 18, N. Y. This company is now the exclusive distributor of decorative micarta as a result of an agreement with Westinghouse Electric Corp.

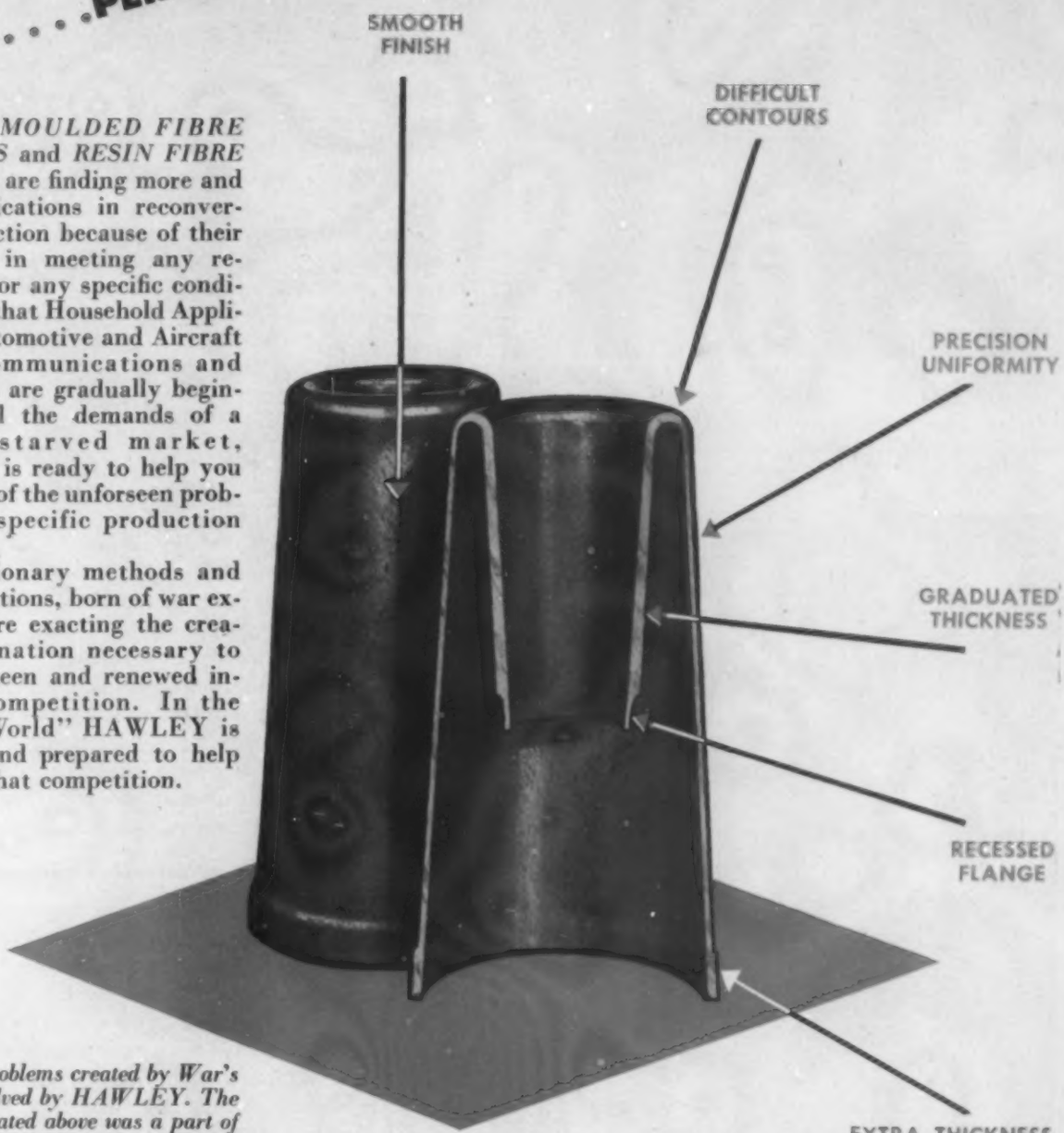
Sorry!

★ In the article "Cast plastics for precision optics" which appeared on pages 116 to 118 of the January issue, we mistakenly said that when the war shut off our supplies of quinine, Poloroid developed a new plastic film which was polyvinyl acetate. Actually, this film is a polyvinyl alcohol.

PERTINENT POINTS IN A PLASTIC

HAWLEY MOULDED FIBRE PRODUCTS and *RESIN FIBRE PLASTICS* are finding more and more applications in reconversion production because of their versatility in meeting any requirement or any specific condition. Now that Household Appliances—Automotive and Aircraft parts—Communications and other fields are gradually beginning to fill the demands of a product-starved market, HAWLEY is ready to help you solve some of the unforseen problems and specific production demands.

Revolutionary methods and new innovations, born of war experience, are exacting the creative imagination necessary to meet the keen and renewed industrial competition. In the "Plastic World" HAWLEY is equipped and prepared to help you meet that competition.



One of the problems created by War's needs and solved by HAWLEY. The article illustrated above was a part of a war product. Note the pertinent points in construction that have successfully withstood terrific stresses. Aside from tensile strength and durability, it is light in weight—an important advantage in many production purposes.

LICENSING MANUFACTURERS

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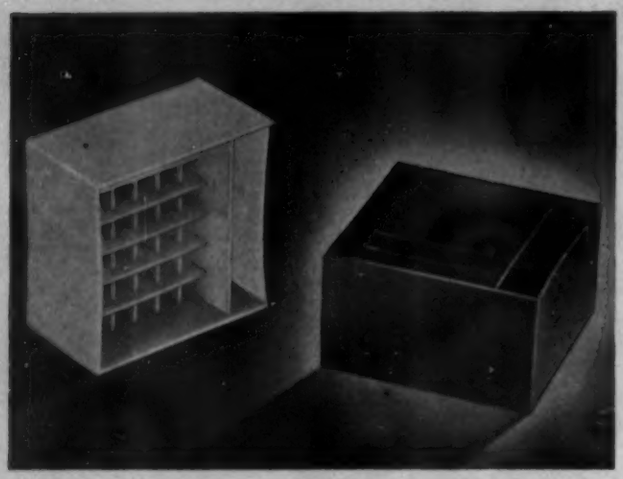
A report from England

by ISLYN THOMAS*



Advanced work being done in England with polythene is typified by this battery case with small nest-like compartments

This machine is specially adapted to injection molding of large heavy-section polythene parts. It accommodates two molds, fed by separate sprues from one injection cylinder

FROM the time, a little over six years ago, when the sirens first sounded the approach of enemy aircraft in Great Britain until the last shot was fired, the plastics industry of Great Britain, was plagued by the lack of materials, proper equipment and many other of the essentials for successful plant operation.

But while these shortages had their compensations from them came an increased knowledge of the wide range of uses to which plastics could be adapted—a knowledge that stemmed directly from the necessity of substituting one plastic material for another. For example, before the war, approximately 90 percent of the polystyrene molding powder used in Great Britain was imported from Germany, the other 10 percent came from France. With the advent of the war the few tons of polystyrene made monthly by a British firm was only a drop in the bucket. Finally even this source of supply became non-existent. As a result, many wartime plastic products which would have been made of polystyrene were molded of cellulose acetate or the newly developed polythene.

As far as the British development of polythene is concerned, the country's need for the material can be credited with the progress the plastics industry made in its handling. As an example, take the polythene battery case for an aerological balloon (shown in Fig. 1). Even in one of the more popular thermoplastics this would have been a rather difficult piece to injection mold due to the venting problem created by so many small individual nest-type compartments. Incidentally, this part was molded on an oldtime 4-oz. air-actuated Eckert and Ziegler machine.

Shortage of injection machines

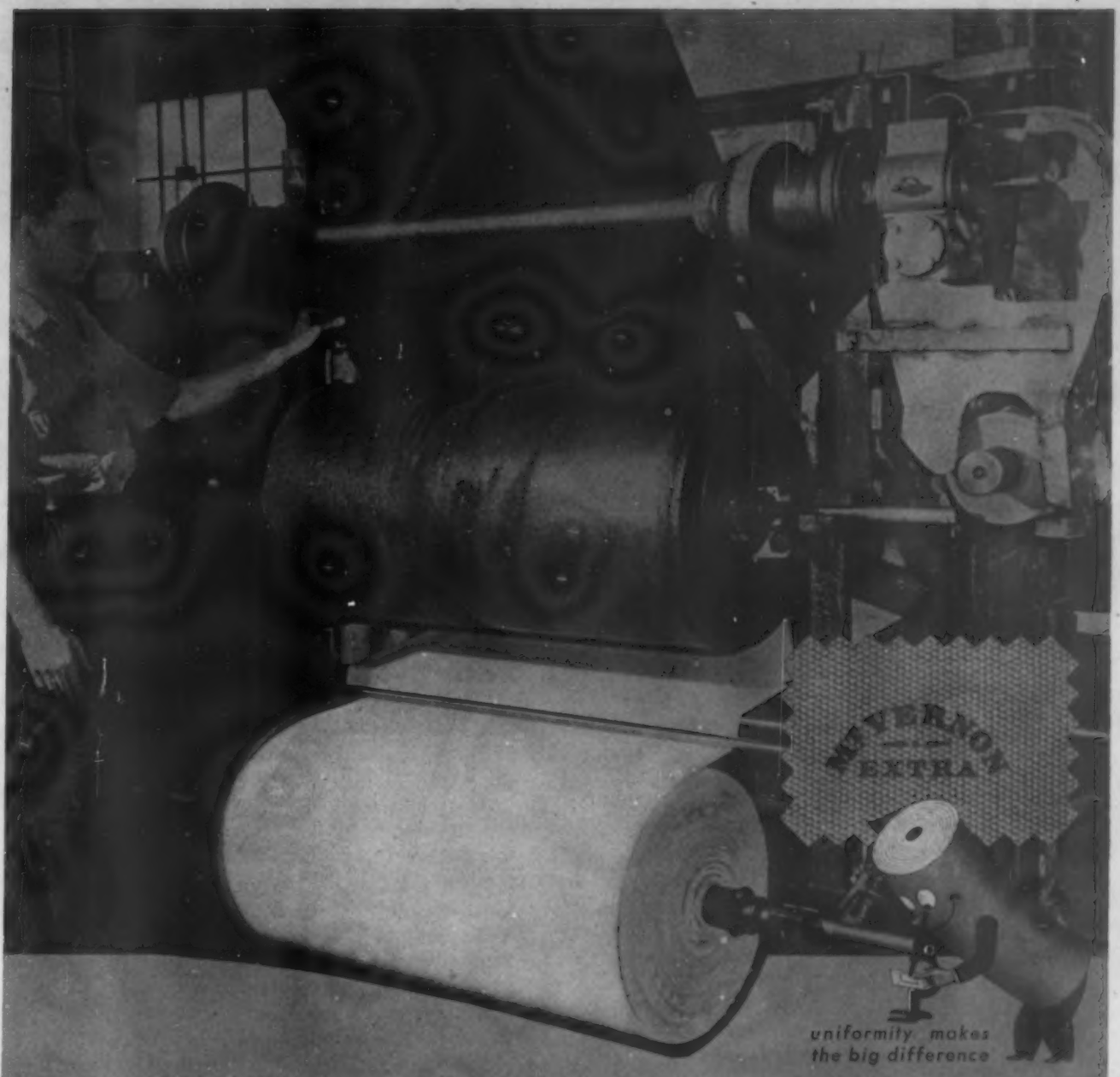
To produce essential civilian items, many British firms had old hand-operated horizontal Shaw injection machines in operation. One of these machines was being run at better than 8 shots per min. with all operations completely manual.

Here in the United States we have upwards of 1650 injection machines in operation; in Great Britain there are approximately 600 machines, the greater portion being under 2 oz. in capacity. The largest available injection machine in England is a 16-oz. American-made Lester machine installed at Injection Moulders, Ltd., London.

It was surprising to see old German equipment like the Isoma and the Eckert and Ziegler injection machines in operation, and a number of unique home-made vertical machines similar in design and operation to the old Grotelite injection machine. In the majority of plants, however, modern American and British injection machines operated alongside antiquated units.

Not being satisfied with standard injection equip-

* Thomas Manufacturing Co.



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ment, British ingenuity developed a new type of injection machine (Fig. 2) designed primarily for the production of large heavy-section polythene parts. In the designing of this machine, first consideration was given to the necessity for temperature and pressure to be maintained during the molding cycle in the production of heavy sections.

In order to somewhat speed up the normally slow production, the machine was designed to accommodate two separate molds, each with a separate sprue fed at right angles from the single injection cylinder. Projecting from the pillar casting at the front and back of the machine are adjusting tables for mounting the molds. Vertical adjustments of these tables are controlled by hand wheels to make it possible for the front and back nozzles to line up with the sprue openings in the molds.

In the field of compression and transfer moldings, the British have successfully molded parts such as the compression molded base used in the bomb preselector from stiff flow high dielectric wood-filled phenolic material. Another difficult molding job was an impeller which was transfer molded from medium shock-resistant phenolic and ejected from the mold by unscrewing the part.

Skilled help a reconversion problem

Many of the larger British molding firms make their own tools and dies, the smaller plants depending on outside tool shops just as in this country. One of the biggest problems as far as speedy reconversion is concerned is the absence of skilled craftsmen to make the necessary new molds. The acuteness of the situation has been caused by the skilled tool makers being drafted into the armed services, along with the younger apprentice boys who were learning the trade. Due to higher pay in other industries, these apprentices are now reluctant to start at apprentice wages. For this reason it will take many years to build up a supply of skilled craftsmen. Many British plants purchased American made molds in order to alleviate this problem.

To summarize, it can be said that the British made excellent use of antiquated equipment and when this did not suffice, developed makeshift machines.

Hobbying in plastics

The great enthusiasm which the novice has for plastics is frequently dampened by insufficient working knowledge and a lack of proper tools and materials for producing the various articles. A well-equipped set, such as the one that Plexity Products Co. produces under the name of Plastic Craft Kit A-160, can do much to furnish the proper incentive for the beginner.

This kit is concerned solely with the fabrication of acrylics. Instead of offering merely vague suggestions as to articles which may be made, the kit furnishes complete instructions for definite projects, along with the proper materials and tools for making them. For instance, a project for fashioning napkin holders includes 8 thin strips of Plexiglas for the body of the ring, a wooden jig for heat forming and blocks from which decorative figures for mounting on the rings can be cut. One of these is already cut and finished in the shape of a horse as a suggestion of what can be done. Other projects include fabricating paper weights, cut-out figures and miniature double picture frames. Complete instructions and sketches are given for each of these.

A frequent stumbling block for the beginner is the difficulty in obtaining buffing compounds, wet abrasive paper, pumice, polishing wax and welding solvent in small quantities. For this reason, the manufacturers have taken care to include these in the kit. Also included are polishing cloths and two manuals, one on fabricating and the other on plastic applications, which give the user enough basic information on plastics to enable him to make intelligent use of the kit.

The set is designed so that it can be used by a person in a wheel chair or even in bed. The only items needed to start work, other than those furnished, are an inexpensive coping saw and a pan of water for the abrasive paper.

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SEE OUR CATALOG IN SWEET'S

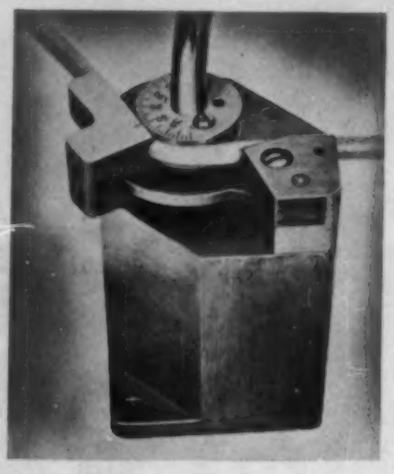
New machinery

(*Continued from page 208*) ing head—adjusted by a hand knob on the machine itself for marking depth. A numbering machine for automatic advance is mounted in the marking head and in the oversize frame of the number machine. For repeat marking, mortises for insert dies are placed before and after the numbering wheels. The inserted dies are interchangeable and held in position by set screws.

★ De Sota Tool Co., Detroit 1, Mich., has developed a new boring chuck with which it is possible to center drill a hole, that is, bore a hole and then drill again without removing the boring chuck. The chuck may also be used as an adaptor for a wide variety of special tools such as end mills, cutters, key-way cutters, saws and fly tools. Made in five standard sizes, the unit consists of only four parts made to standard gages so that any part can be replaced in a few days.

★ A recent development of Precision Scientific Co., Chicago 47, Ill., is an oil immersion type aging bath for aging rubber or elastomers in oils, or liquids in test tubes, according to ASTM D-471 and D-375. Capacity is 24 test tubes, 38 mm. in diameter by 200 or 300 mm. in length. The tubes are supported by an adjustable stainless steel rack which rests directly in the bath and can readily be removed. The top shelf of the rack guides the condenser in a vertical position. Constant temperatures, ranging from 35 to 200° C. with an accuracy of plus or minus 1° C., are provided by hydraulic thermostat-controlled immersion heaters. A ball-bearing, fully enclosed resilient mounted motor stirrer supplies complete circulation. Including the rack, the unit is 49 in. high, 24 in. wide and 24 in. deep.

★ Glenn L. Martin Co., Baltimore, Md., has developed a new hand-bending tool which is designed to permit all types of small tubing to be curved to any desired angle. The unit consists of a sturdy steel



base for use in a vise or clamped onto a bench, a revolving radius rod equipped with a handle for turning, a stop block grooved to hold tubing and a movable radius block which guides the tubing around a bend roll centered on top of the base. The roll, cylindrical in shape and grooved, has a top plate scribed in 360°.

★ Gustin-Bacon Mfg. Co., Kansas City, Mo., has announced the development of the Flexigrip tubing fitting. This new device eliminates the need for special end preparation or soldering of tubing, yet produces a stronger, leakproof and flexible joint. Available in brass, aluminum or steel in standard sizes from $^1/_8$ to $1^1/_2$ in. O.D., the fitting consists of four parts—the body, a gripping ring, a synthetic rubber gasket and nut.

★ The CycleLog controller has been designed and manufactured by the Foxboro Co., Foxboro, Mass., for batch-type processes and other operations where rate of temperature increase or decrease must be controlled. This control is completely automatic. In batch-dyeing, for example, the unit will bring the bath temperature from any starting point to the desired holding point at any rate of rise from 1 to 8° F. per min. and will hold the bath at the correct temperature for the required time, then shut off the heat supply and signal operator that cycle is finished.

★ A new line of hydraulic and air cylinders has been announced by Miller Motor Co., Chicago 18, Ill. Provided with all-steel heads, caps and separate interchangeable steel mountings, the cylinders in addition are universal and may be mounted either directly on the extended tie rods or attached to the tie rods with any of the standard styles of brackets. By simply changing the steel brackets, it is possible to adapt a cylinder to different uses. Also offered are special tie rod mountings which extend on either or both ends of the cylinder.

Acetylene for new products

(*Continued from page 176*) lene on the other hand, stoichiometrically using nickel carbonyl and acids, as well as catalytically. The theory of the reaction process was also discussed. In the meantime the new catalytic acrylic ester synthesis has been developed as a continuous operation on a semi-commercial scale so that its full-scale production can be started at any time. The same holds true for the acrylic amides, especially acrylanilide from aniline, carbon monoxide and acetylene.

Cyclopolyolefins

Lately, we have succeeded in polymerizing acetylene via benzene to cyclopolyolefins of the formula $C_{2n}H_{2n}$ (n—3). The main representative of this group is cyclooctatetraene, which is obtainable from acetylene with a yield of 90 to 95 percent of theory. The reaction has already been accomplished in continuous operation. The preparation of the higher ring homologs, e.g., the deep-blue cyclodecapentaene, is still under investigation. The reaction takes place in a similar manner, but at higher temperatures. The cyclopolyolefins have to be considered as intermediates of the cuprene formation. We apparently succeed by special catalysts and reaction conditions in stopping the cuprene formation with the polyolefins.

The fact that acetylene can be polymerized to cyclooctatetraene and the higher ring homologs on the ring (cyclodecapentaene, cyclododecahexaene, etc.) is very astounding. Up to now one could only obtain, apart from benzene by the Berthelot process, aliphatic polymers of acetylene (vinylacetylene, divinylacetylene, butadienylvinylacetylene by the Nieuwland process). Thermodynamically, this result is also surprising, since cyclooctatetraene possesses a higher energy content than benzene.

Heat of formation	*kcal./mol*
Cyclooctatetraene	40
Benzene	12
Heat of combustion	
Vinylacetylene	569
Benzene	783.4
Cyclooctatetraene	1069

Cyclopolyolefins can be subjected to all reactions which are customary for double and triple bonds in the

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DEMAND FOR KYS-ITE has been so heavy that we cannot handle further specialty orders at the moment. With materials and manpower becoming more available, this situation is improving, however. Before long we hope to be ready for new business.

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aromatic and aliphatic series. On account of the manpower shortages, we have been obliged to limit ourselves mainly to the production of cyclooctatetraene and could only study a few reactions of the interesting cyclopolyolefins. In the course of these studies, the previously mentioned suberic acid was prepared by oxidation of the cyclooctane, obtained by perhydrogenation of cyclooctatetraene.

The ready availability of the cyclopolyolefins as the result of our work combined with their extraordinary reactivity now opens up a new important field of scientific and industrial chemistry, the scope of which cannot be foreseen today. The introduction of the various substituted acetylenes, diacetylenes and polyacetylenes has also provided an unpredictable scope for this new reaction.

Conclusion

It is absolutely impossible within the framework of a lecture to cover completely and thoroughly the fields discussed here today. I have only been able to give you an indication of the extent of our work. The investigation of the whole field and the testing of the various substances which have become accessible to us for their industrial use will keep us busy for many years to come. The ways and means by which we have studied chemistry during the last years in Ludwigshafen have led us to a kind of *building block* chemistry, as I would like to call it. It enables us to build from the smallest of building blocks, such as CO, H_2, CO_2, H_2O, acetylene, ethylene, ammonia, amines etc., on the basis of newly discovered reactions, industrially important groups of chemicals which are relatively complicated and extremely reactive. A great part of the success of this work is due to the application, for the first time, of the reactive acetylides of the heavy metals, and of the metallic carbonyls in organic synthesis. There is no doubt that if our *building block* chemistry is pursued astutely and tenaciously, still further great results will follow. Only recently it has developed, for example, that cyclopentadienone, hydrindon, and even hydroquinone can be obtained by direct reaction from the simple building blocks—acetylene, CO, and H_2—by making use of the metallic carbonyls.

Agricultural residues

(*Continued from page 180*) compounds that were a little short in flow properties were improved by the addition of zinc stearate to the molding powder.

The density of these inorganic-extended compounds ranges from 12 to 20 percent higher than that of the organic plasticized compounds. Good dimensional stability of these compounds is indicated since the shrinkage is well within the range of that for commercial molding compounds. Dimensional change between "as molded" and conditioned specimens is negligible so that the tendency to crack as the result of internal strains should be at a minimum. Although many of these compounds had been prepared experi-

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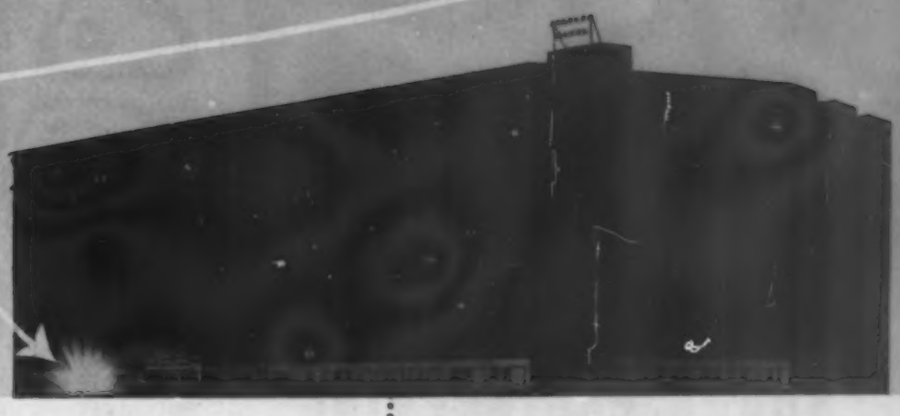

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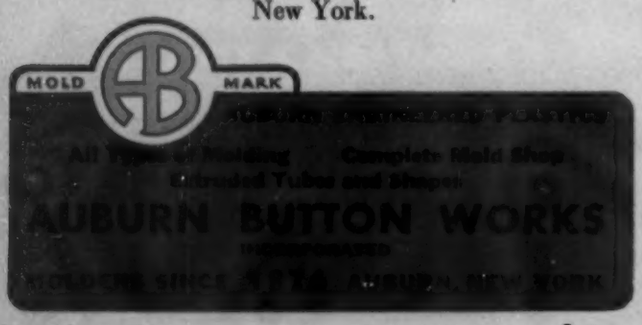

mentally with an excess of moisture, the residual moisture presented no problem in molding. Preforms can be heated electronically to obtain optimum conditions for good molding. The surface finish for the organic plasticized compounds was good and for the inorganic-extended compounds it was excellent.

Compounds with 25 percent of resin

The compounds that contained organic plasticizer are not economically feasible because the varnish type of resin used in these compounds is too costly at the present time. However, they show that thermosetting compounds with excellent molding and physical properties can be made with comparatively large amounts of plasticizer, if the proper phenolic resin-plasticizer combination is used. They indicate the possibility of producing thermosetting compounds with a wider range of properties, especially with respect to toughness and elasticity.

The inorganic-extended compounds are economically feasible because the resin used in these compounds is priced within the usual range for commercial phenolic resins. Assuming a cost of 15 cents per pound for the resin, the relative cost of raw materials for a compound with 50 percent of resin and for a compound with 25 percent of resin, extended with 25 percent of precipitated chalk, is shown in Table II.

CONCLUSIONS

Thermosetting agricultural residue molding compounds with only 25 percent of phenolic resin and with organic plasticizers or with inorganic extenders have been produced not only to meet the minimum specifications for general-purpose molding compounds, but in some cases to exceed by 40 percent the flexural and tensile strengths required by the specifications. The technique of manufacture of these compounds is the same as that commonly used in commercial practice. A saving of 26 percent in cost of raw materials is indicated for these compounds with 25 percent resin as compared with compounds with 50 percent of resin. These low-resin agricultural residue compounds provide two distinct advantages: namely, a marked saving in the more costly phenolic resins and a wide geographical distribution of the fibrous component.

Are you in search of plastics information?

WHAT do you want to know about plastics? Are you looking for a stock mold knob, or have you seen a plastic product you want to buy? Is there a trade mark you are trying to identify?

MODERN PLASTICS offers you—without charge—the facilities of its Readers' Service Bureau, a department which makes every effort to answer questions submitted to it, and to direct inquirers to sources of supply or channels of technical information.

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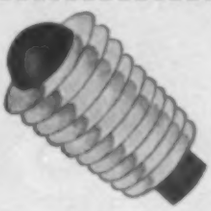
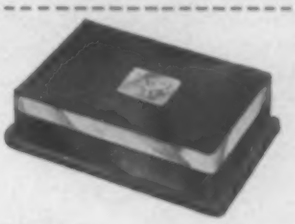
When metal is required in a plastic product, the best answer is Alcoa Aluminum. The reason plastics and aluminum make such a great team is a simple one: you *gain* all of the properties of aluminum without a big *loss* in the lightness, and other characteristics that plastics are famous for! Let's do a little Imagineering . . .

MECHANICAL strength can be added to molded parts without burdensome weight. Fastening inserts, or structural reinforcements are light, strong; available in many cases from stock.

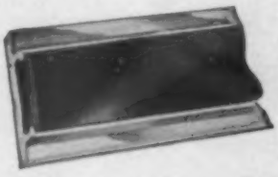
ELECTRICAL conductivity of aluminum is high. Perhaps you're thinking about a molded plastic electrical part where aluminum inserts provide the necessary conductivity. They're strong, too!



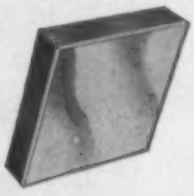
THERMAL properties of aluminum are excellent. Let's say you're designing a plastic product which must be air-cooled. You might use aluminum discs, molded in as above.



DECORATIVE values of aluminum are a long story in themselves. Use it plain, or with frosty or mirrorlike Alumilite or colored finish (patented process). Remember, it's light!

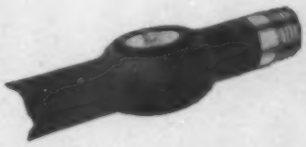


EXTRUSIONS of plastic combined with extrusions of aluminum? Why not? One supplements the other, in beauty and strength. Alcoa Aluminum is available in many stock shapes.



LAMINATED plastics can be faced with aluminum sheet for a new idea in modern materials. Or, why not inset Alcoa Aluminum decorations in your dark laminates? Highly attractive!

FORMED plastic sheets team up well with Alcoa Aluminum as in this navigator's dome. The whole assembly is light, strong, easy to mount. Is there a household idea here?



CHEMICAL properties of aluminum supplement those you like to stress in plastics. Can it help you in products for textile, process, petroleum, pharmaceutical, food industries?

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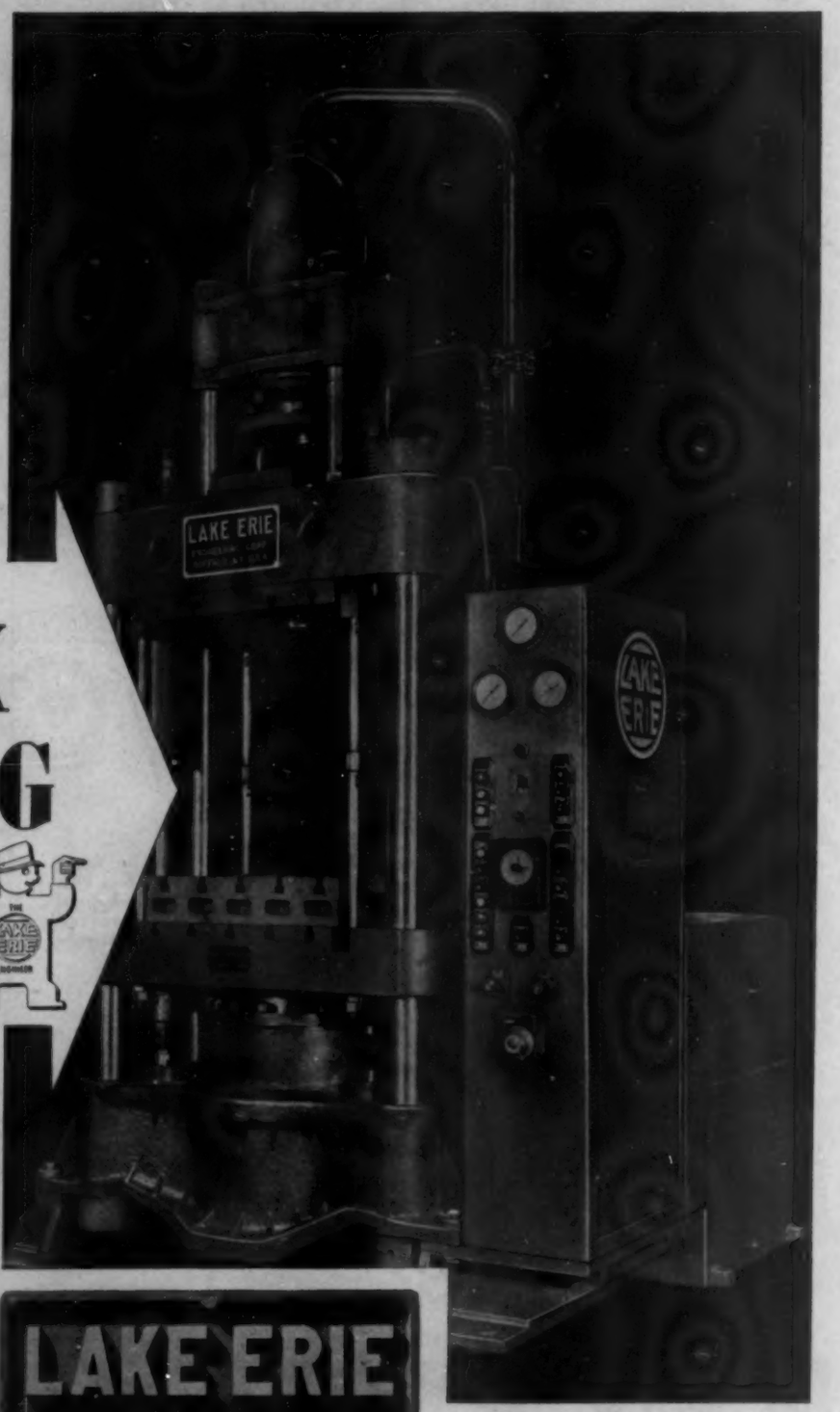

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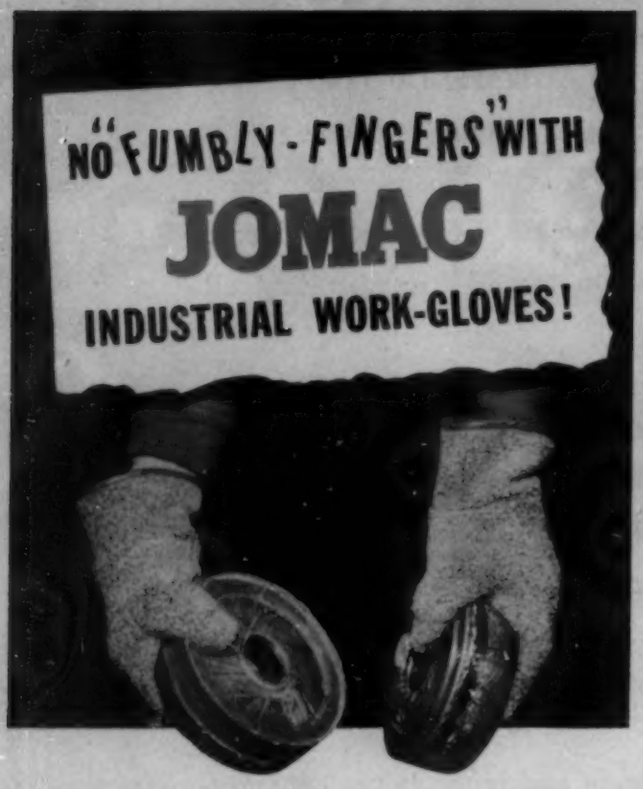

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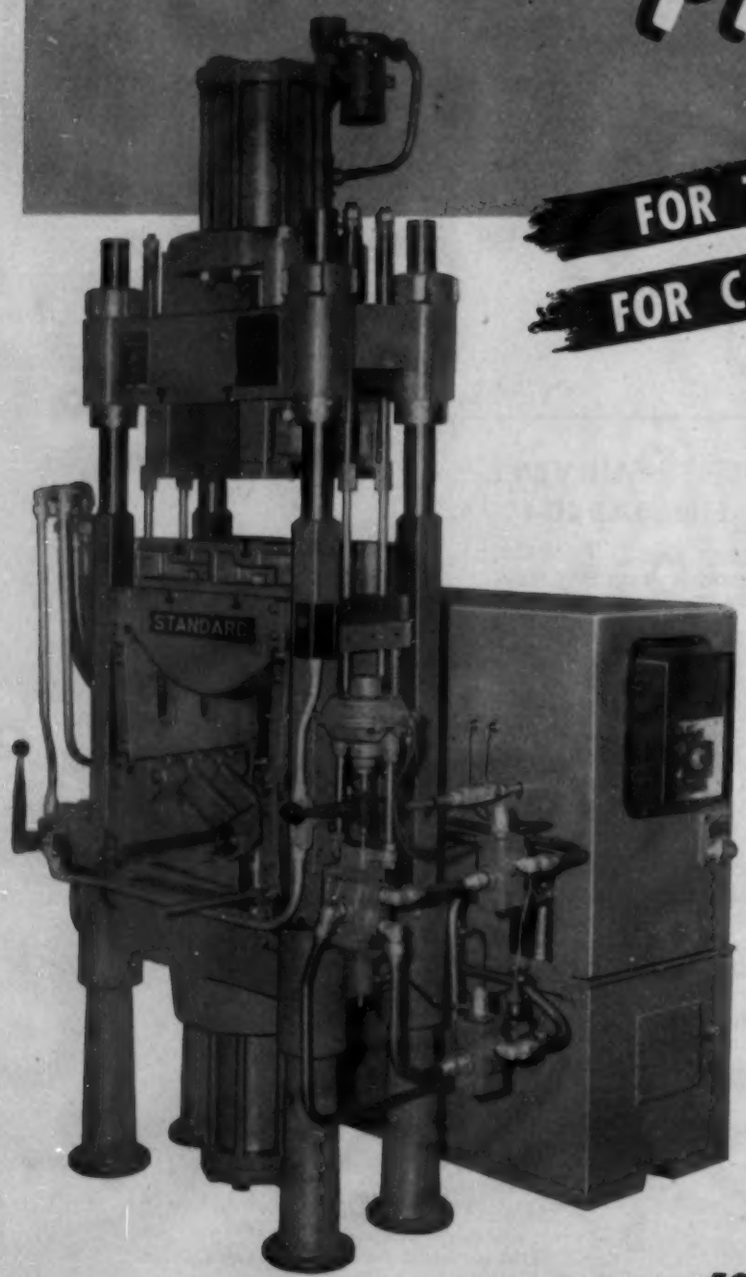

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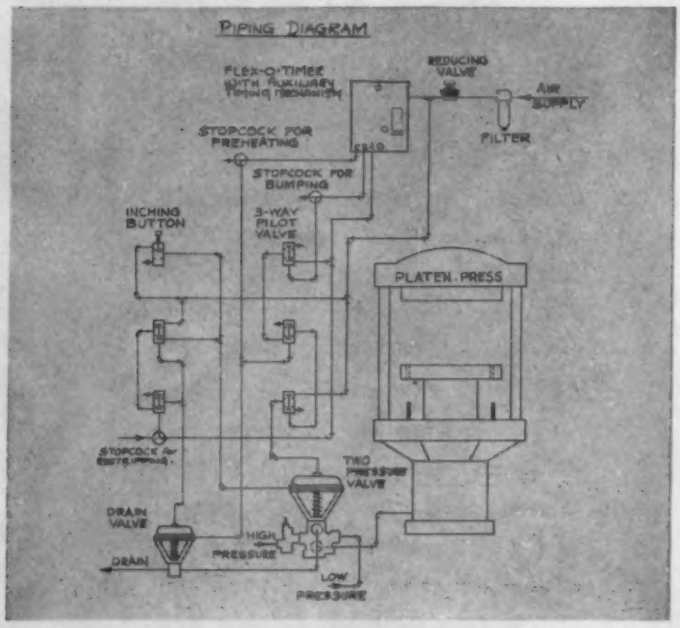

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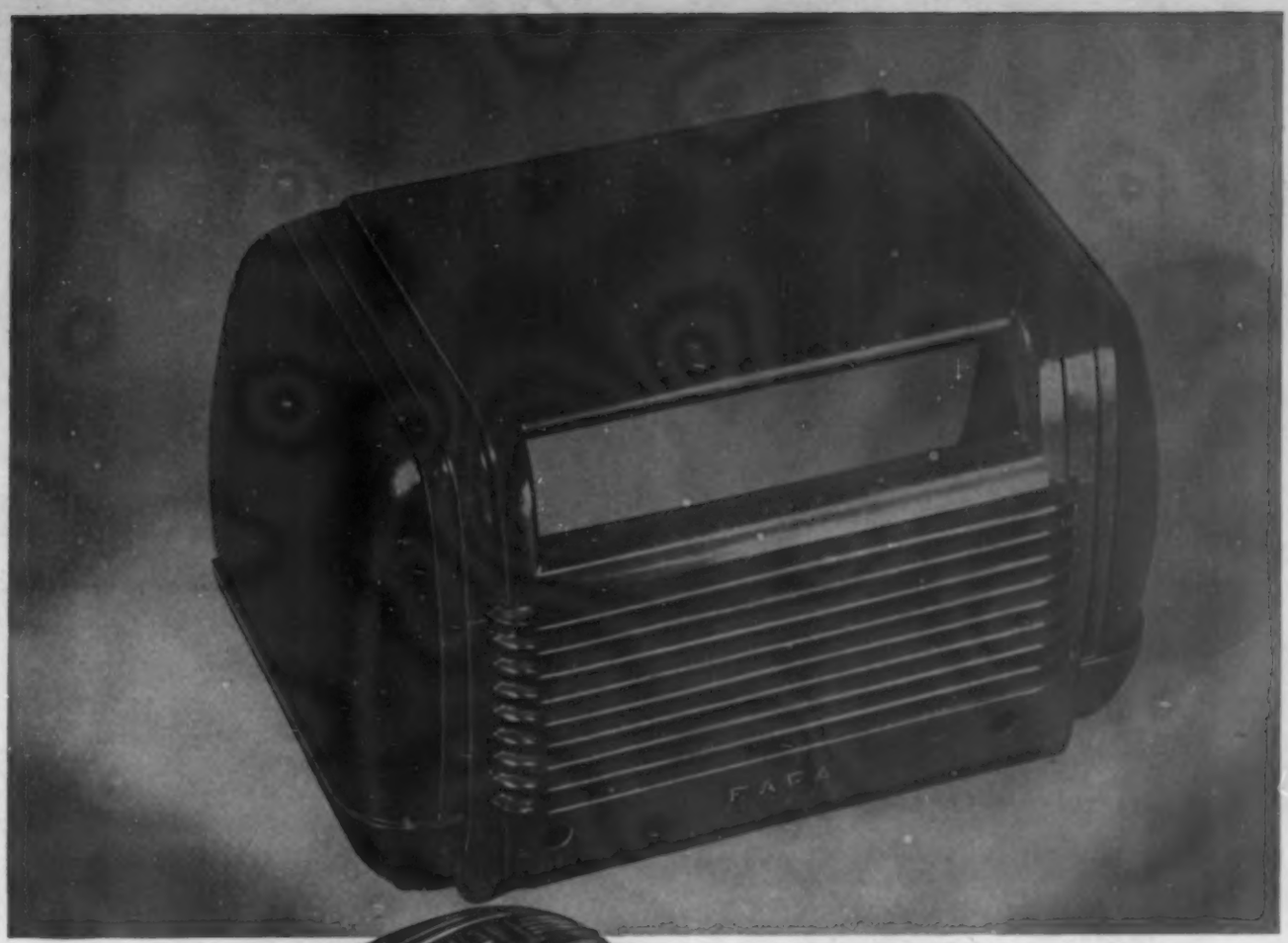

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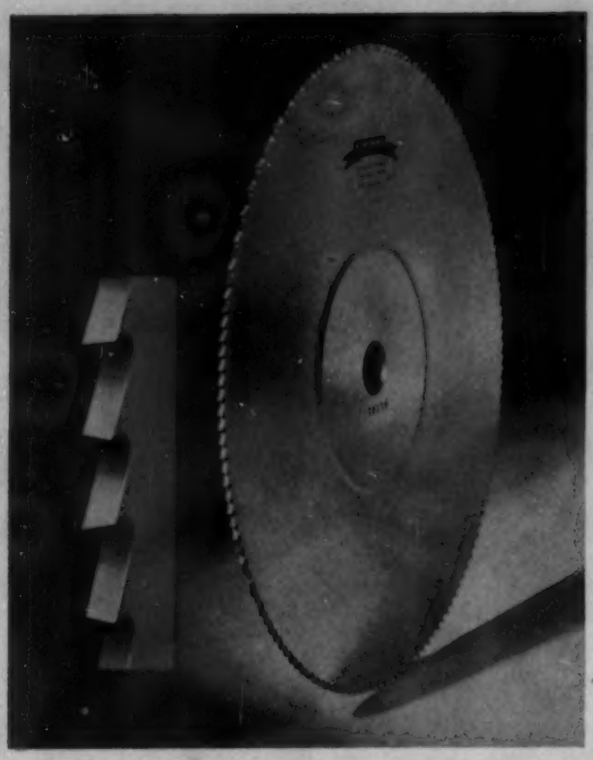

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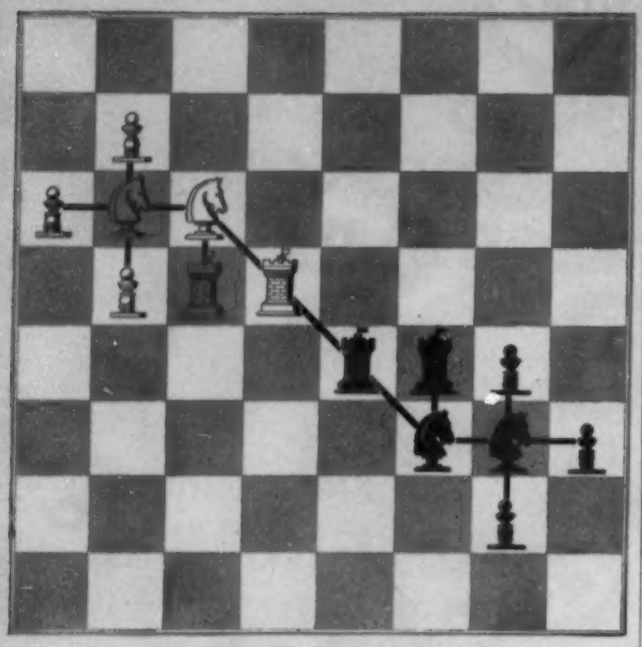

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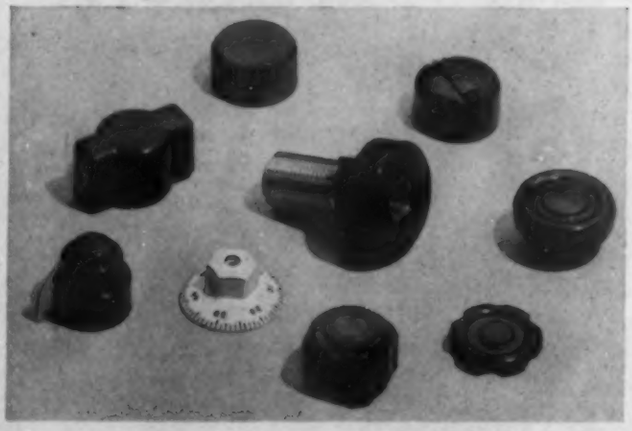

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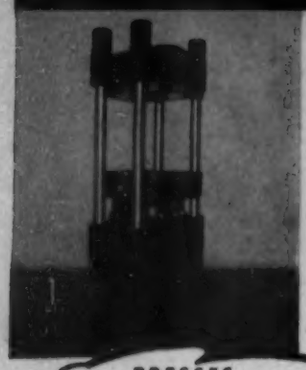

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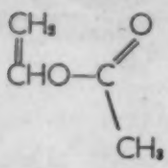

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INFRA-RED in the PLASTIC INDUSTRY

Branch of the Industry	Name of Appliance	Use
Molders (Thermo-setting) Compression	PELLET-VEYOR (Variable heat)	To preheat pellets and preforms at the press as needed
Molders (Thermo-plastic) Injection	VIBRA-VEYOR (Variable heat)	To preheat plastic powder automatically. To dry plastic powder automatically
Injection	HOPPER-HEATER (Variable heat)	To warm up heavy metal of hopper of molding machine
Molders (Thermo-plastic) Extrusion	STRIP-HEATER (Variable heat)	To preheat strip rolls of vinylite, etc., automatically as fed to worm
Material Manufacturers	Special production equipment including vibrators, conveyors, stainless steel belts and electronic devices	To process various kinds of plastic material in bulk
Fabricators (Miscellaneous)	BENCH-KIT In various sizes (Variable heat)	To soften sheets, rods, tubes and any shape for bending, forming, punching, etc. This includes Cellulose, Acetate, Methyl Methacrylate

(The time on most of the operations mentioned above averages five minutes)

THE MISKELLA *INFRA-RED* COMPANY
DESIGNERS — MANUFACTURERS OF
INFRA-RED OVENS • APPLIANCES • SECTIONAL UNITS • MACHINES AND CONVEYORS
Main Office and Laboratory
East 73rd and Grand Ave. Cleveland 4, Ohio

FABRICATORS of MARBLETTE, BAKELITE, CATALIN, LUCITE, PLEXIGLAS

•

We work to blueprint specifications

MANUFACTURERS OF
ALL TYPES OF PLASTICS
GAMES FOR ADULTS

Send us your inquiries.

SPI SOCIETY OF THE PLASTICS INDUSTRY

A&L
MANUFACTURING CO.
9 FLORENCE ST. BROOKLYN, N. Y.

Ideal Scrap Grinder
in
CRUVER MANUFACTURING CO. PLANT

The operator is feeding a quantity of thermoplastics scrap into the Ball & Jewell Ideal Standard scrap grinder. Note the sturdy construction of this space saving machine. Outboard SKF ball bearings sealed against dirt and dust. Motor attached to chasis with Texrope drive, thus cutting down floor area required. Special baffled hopper prevents accidents and waste. Removable bin allows easy material changeover. Simple construction, solid tool steel knives. 3 interchangeable screens for different granulations.

Ball & Jewell scrap grinders are standard throughout the plastics industry for speed, efficiency, safety and economy. They actually pay for themselves in materials saved and reused. A size for every plant, from the smallest molder or extruder to the largest raw materials manufacturer.

Send for free catalog of all models.

BALL *and* JEWELL

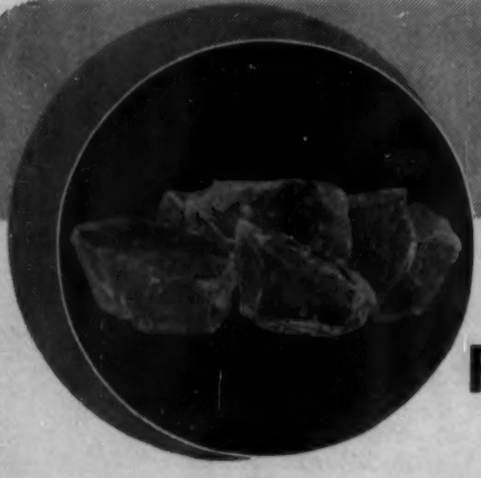
20 Franklin Street, BROOKLYN, N. Y.

Since 1893, Manufacturers of Patent Rotary Cutters

CHICAGO: Neff, Kohlbusch & Bissell. DETROIT: J. C. Austerberry's Sons. LOS ANGELES: Moore Machinery Co. LOS ANGELES & SAN FRANCISCO: Machinery Sales Co. NEW ENGLAND: Standard Tool Co., Leominster, Mass. ATLANTA, GA.: George L. Berry. ST. LOUIS: Larrimore Sales Co. CLEVELAND 22, OHIO: L. F. Willmott, 3701 Latimore Rd. SEATTLE 4, WASHINGTON: Olympic Supply Co. KANSAS CITY, KANS.: Fluid Air Engineering Co. AUSTRALIA and NEW ZEALAND: Scott & Holladay Pty., Ltd., SYDNEY, STOCKHOLM, SWEDEN: Ingenjorsfirman Teknova. CANADA: Williams & Wilson, Ltd., Toronto & Montreal.

HAWAIIAN ISLANDS: Hawaiian Sales Service, P. O. Box 3498, Honolulu, 11, T. H.

This is #14 of a series of advertisements showing typical Ball & Jewell scrap grinder installations in the plastics industry.



RESINS and PLASTICIZERS

Produced Under Precision Controls for Exacting Plastics Production . . .

PICCOLASTIC Modified Styrene Resins in a wide range of molecular weights, melting points and solvencies. In combination with each other or with other plastic bodies make possible the creation of results hitherto unattainable . .

PICCOLYTE . . Hydro-Carbon Terpene Resins chemically inert, acid and alkali resisting, compatible with all rubbers, coal tar residues, pitches, paraffins and waxes. Clear color permanence . . .

PICCOUMARON Para Coumarone Indene Resins. Offered in light and dark color in a wide range of melting points . .

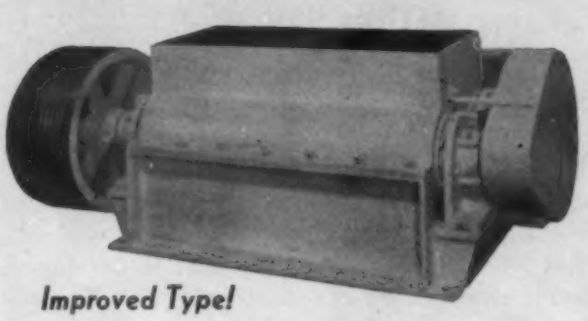
A complete line of Precision plasticizers to meet the requirements of all types of plastics compounding . . . Our laboratory will assist in determining the plasticizer best suited to your compounding problems. Write for complete data

STANDARD Chemical Company

General Offices AKRON 8, OHIO

ROBINSON
PROCESSING UNIQUE EQUIPMENT

SAW TOOTH *Crushers*



Improved Type!

Rugged construction. Crushes material to finished size. Blades spaced to your specifications. Capacity from 3 to 15 tons. Roller bearing mounted shaft. Robinson Processing Equipment designed by engineers whose reputation is founded upon doing things right. Literature available. Inquiries invited.

ROBINSON MANUFACTURING CO.
Plant: Muncy, Pa.
SALES REPRESENTATIVE
MERCER-ROBINSON COMPANY, INC.
30 CHURCH ST., NEW YORK 7, N.Y.

SPECIALISTS
INJECTION MOLDING

THE
GROTELITE CO.
INCORPORATED
GRANDVIEW & LAFAYETTE AVE.
BELLEVUE, KENTUCKY

"PIONEERS IN PLASTICS"
ESTABLISHED 1922

How To Make Molds Give
PERFECT FINISHES and LONGER RUNS

• First you have the problem of getting the mold to take a mirror finish. And then it must *hold the finish* over a long run.

To be sure of getting the molding results you want on each job, specify Carpenter Mold Steels. They are clean and uniform . . . 100% Acid Disc Inspected. They protect hours of labor that go into mold-making, offer a sure way to reduce the cost of mold-making.

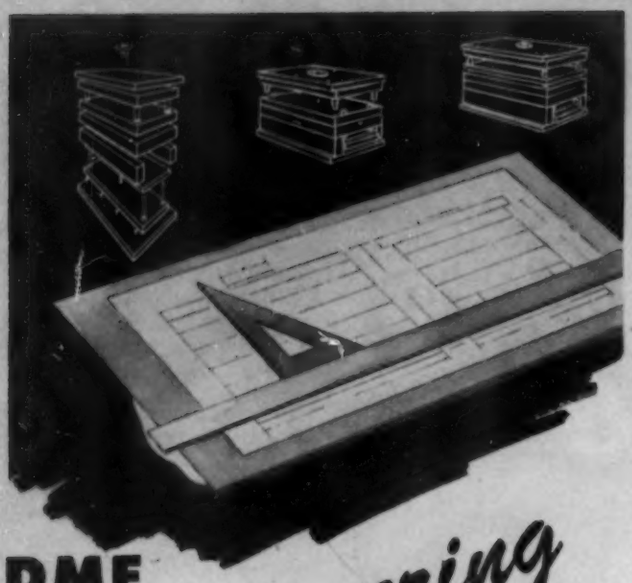
One of several molds used for making Keyes Fibre Company's *Kys-ite Trays*. Molds made by Atlas Tool Works, using Carpenter *Samson* Mold Steel.

If you would like useful information on selecting the proper mold or hob steel for each job, ask for a copy of "Tooling Up for Plastics." This 36-page book is used as a reference guide in hundreds of plants where long runs, perfect finishes — and lower costs — are important. For your copy, drop us a note on your company letterhead.

• And for personal help with your mold steel problems, get in touch with your nearby Carpenter representative. He knows mold steels from A to Z and can be of real service to you.

THE CARPENTER STEEL COMPANY
112 West Bern Street, Reading, Pa.

Carpenter — CLEAN DIOK
ELECTRIC FURNACE
MOLD STEELS
100% ACID DISC INSPECTED



DME *Engineering* SAVES YOU TIME

YEARS ago DME conceived the idea of a standard mold base that would simplify molding problems. Mold-makers quickly welcomed these engineered standard bases—built in popular working sizes for standard presses—delivered ready for immediate use, requiring only the inserting of cavities, cores and ejector pins.

Today DME offers 176 combinations and sizes of standard mold bases to meet practically every molding requirement. DME Mold Bases are time-saving; eliminate days and days of valuable engineering time; enable you to start production faster. Economical – cost far less than custom-built bases and eliminate costly errors in individual mold designing. Parts are interchangeable and can be used on many subsequent setups.

Learn today how you can greatly increase your molding production with DME Mold Bases—the mold bases that have *all the preliminary designing and engineering done for you!*

DME News will be mailed you monthly on request — FREE!

DME
DETROIT MOLD ENGINEERING COMPANY
6686 E. McNICHOLS RD. • DETROIT 12, MICHIGAN

Vital NEW information, much of it developed during the war, awaits you at the 20th Exposition of Chemical Industries at Grand Central Palace, New York, from February 25 to March 2 —*practical* information . . . and *more of it* than has ever been marshalled together *anywhere.*

Visitors will find concentrated at the Exposition a review of chemistry's important recent advances . . . factual data on new equipment, new processes, new materials, much of which can be revealed only now.

You'll find technical representatives of the companies that have wrought the war-time miracles of chemistry. They will be here with displays and exhibits, and prepared to discuss with you, personally, the ways you may adapt the newest techniques, equipment and materials to your own peacetime plant.

To chemists, engineers and plant executives seeking to apply to their own problems the benefits of chemistry's latest advancements, attendance at the 20th Exposition of Chemical Industries may pay dividends for months to come.

The Exposition is not open to the general public. Admission is by invitation and registration. Come and bring your associates.

20TH EXPOSITION OF
CHEMICAL INDUSTRIES
FEB. 25 - MAR. 2
GRAND CENTRAL PALACE
NEW YORK CITY

Management of International Exposition Co.

524

DECORATORS
ON GLASS
AND PLASTIC
CONTAINERS
SINCE 1936
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4 COLORS
IN 1 OPERATION
—FINEST DETAIL

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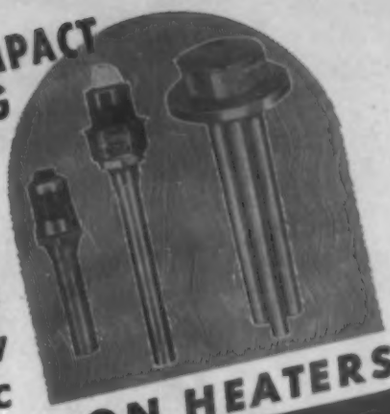
FOR COMPACT HEATING
of
WATER
OILS
PITCH
PARAFINE
and FLUIDS of
VARIOUS DENSITIES



WATLOW
ELECTRIC
IMMERSION HEATERS

Other types in curved flat or round shapes

A compact source of efficient, accurately controlled heating of wide temperature range. Seamless sheathing. Certain sizes available in Monel metal and stainless steel for corrosive liquids. Standard pipe threading.

Diameters from ¾" to 2". Lengths 3½" to 60".

Wattages: From 100 W to 10 K W.

Voltages: Standard 115 and 230 special voltages.

Switches and thermostats available for accurate control.

SEND FOR ELECTRICAL HEATING DATA CATALOG

SPECIALISTS IN ELECTRIC HEATING UNITS

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ELECTRIC MANUFACTURING COMPANY
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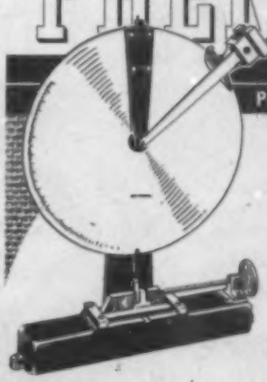
Plastic Marking
IN GOLD, SILVER OR COLORS

Small Designs, Trade Marks, Names, etc.

Clean-cut precision markings on plastic parts at production speeds up to 1,000 per hour, using unskilled operators. Send samples and details of your stamping problems.

Kingsley GOLD STAMPING MACHINE CO.
★ HOLLYWOOD, CALIFORNIA ★

PHENOPREG
FOR REINFORCING
PHENOLIC MOLDING POWDERS



Phenopreg Grade No. 111, a phenolic resin treated cotton duck, can be employed to increase the impact value of regular phenolic molding powders by molding layers of the Phenopreg No. 111 in the cavity charge.

A series of tests to determine the increase in impact value of a wood flour filled phenolic powder when one, two, and three layers of the No. 111 were molded into the center of the impact bar show the following impact values.

Wood flour filled powder with:-	Bar broken with load applied to a. Face of bar as molded	b. Side of bar as molded
1. No reinforcement	.177	.163
2. One layer No. 111	.240	.183
3. Two layers No. 111	.231	.220
4. Three layers No. 111	.633	.236

(Values given are foot-pounds energy to break by Izod test.)

We furnish Phenopreg No. 111 in rolls, sheets, or die cut patterns for reinforcing molding powders. When No. 111 die cuts are employed, half the powder charge is loaded into the mold cavity, the die cut segments placed on top of the powder, the balance of the powder loaded into the mold, and the material molded in the usual manner and regular cycle. The resulting molding does not differ in appearance from regular moldings but has a much higher impact value that will stand up under service in the field with a decrease in customer complaints.

FABRICON
PRODUCTS, INC.
PLASTICS DIVISION
Vinewood 1-8200
1721 PLEASANT AVENUE RIVER ROUGE 18 MICHIGAN

PLASTICS

PRECISION MOLDED IN LARGE VOLUME at DICKTEN & MASCH

In our new modern plant, one of the most up-to-date in the midwest, your requirements are given special attention by experts trained to exactness in the most difficult molding.

WE DESIGN AND FABRICATE YOUR MOLDS

Your product is engineered from start to finish by an able, experienced organization. Skilled men design and completely fabricate your molds.

For plastic molding in all compression and transfer molding materials, write, wire, or call us — today!

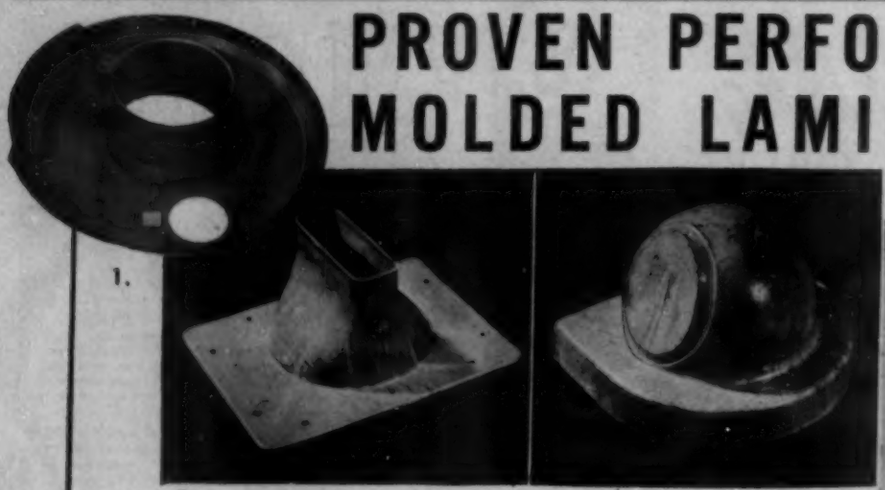
AT YOUR SERVICE NOW

DJM DICKTEN & MASCH Mfg. Co.

Plastic Molding

903 E. VIENNA AVE., MILWAUKEE 12, WIS., EDgewood 4298

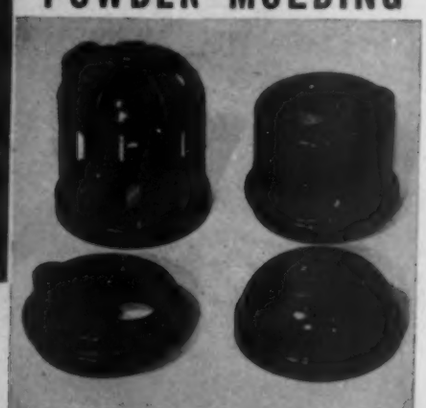
PROVEN PERFORMANCE *in* MOLDED LAMINATES *and* POWDER MOLDING



1.

2.

3.



4.

Unusual mold making and molding skill are necessary to produce these highly complex shapes and large sizes. Radio, Refrigerator, Furniture, etc. are fields in which contour laminates possessing strength, beauty and complex shapes are vastly superior. #1 — is a gunner's floor in a B-24. #2 and #3 are compressor ducts used in a B-29. #4 illustrates an electrical assembly compression molded of phenolic compounds. Our experience in machining and hand finishing difficult molds and our knowledge of molding techniques make us uniquely able to serve you. We are prepared to take orders for new business now.

Thos. J. WHITE PLASTICS Company

SAINT LOUIS 22 MISSOURI

OPEN CAPACITY *now available*

FOR

EXTRUDING AND MOLDING THERMO-PLASTICS

EXTRUDING CAPACITY UP TO 2½"

INJECTION MOLDING 1 OZ. UP TO 24 OZ.

We Design and Manufacture Our Own Dies and Molds

Manufacturers Sheet, Rod, Tubing and Special Shapes

We Can Mark Any Items in Gold or Colors, Names or Trade Marks.

We solicit your inquiries

HUNTINGTON STAMPING & PLASTIC CO., INC.

P. O. Box 1779

Huntington 19, West Virginia

NOW IS THE TIME

to start post war planning and working on plastic molded parts Our engineers will be glad to call and discuss any problem having to do with compression or transfer molded parts.

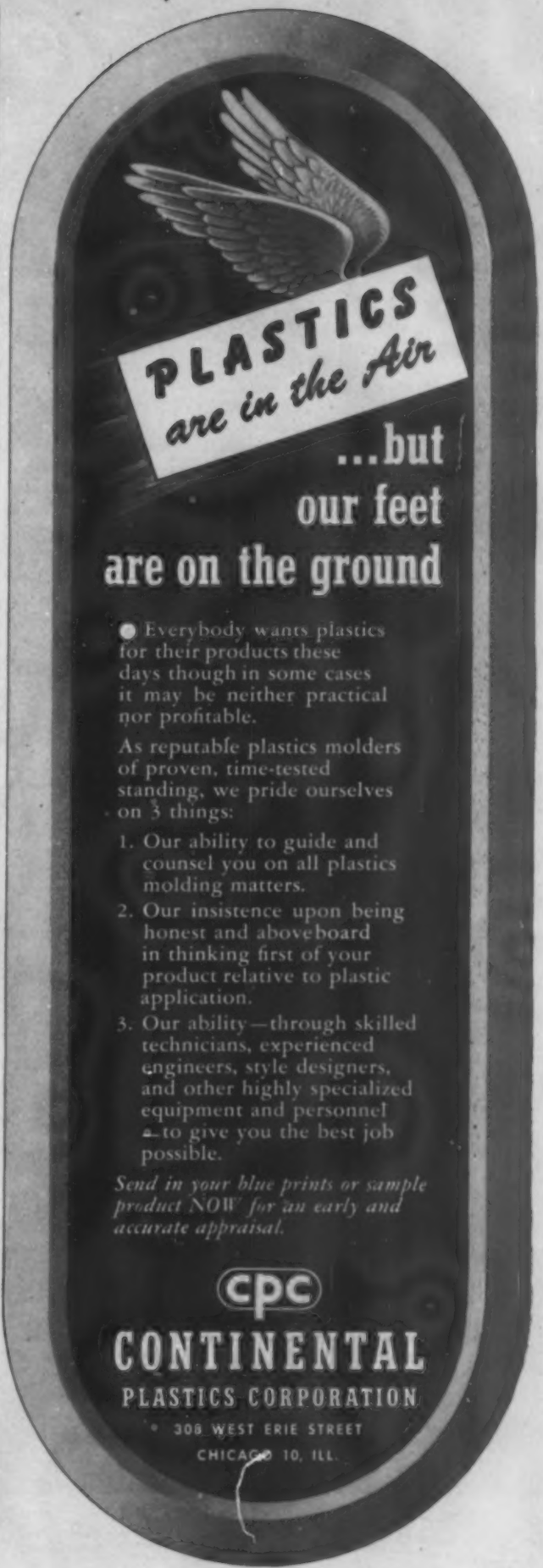
RADIO CABINETS all sizes and other large housings are our specialty

All our molds are made by men with more than thirty years experience. Our engineers offer a similar background of experience. Combined, they guarantee production of highest quality, good looking moldings on the highest possible production basis.

CONSULTATION with our engineers is yours for the asking.

Plastimold, INC.

ATTLEBORO, MASS.



● Everybody wants plastics for their products these days though in some cases it may be neither practical nor profitable.

As reputable plastics molders of proven, time-tested standing, we pride ourselves on 3 things:

1. Our ability to guide and counsel you on all plastics molding matters.
2. Our insistence upon being honest and aboveboard in thinking first of your product relative to plastic application.
3. Our ability—through skilled technicians, experienced engineers, style designers, and other highly specialized equipment and personnel—to give you the best job possible.

Send in your blue prints or sample product NOW for an early and accurate appraisal.

cpc

CONTINENTAL

PLASTICS CORPORATION

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EMERGENCY ENGINEERING

to push your LAGGING development and engineering program through—today . . . spare you lost production PROFITS *tardy* engineering costs you.

Our specially trained crews of reconversion engineers are geared for *speed*. Work in our shop, or under your supervision in your own drafting rooms—for a week, or month or longer until you get caught up. Right now more than 30 B & R crews, numbering 1 to 33 men, are helping *anxious* manufacturers get into production FASTER.

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1 Electronics Engineering
2 Product Engineering
3 Machine Design
4 Tool Design
5 Plastics Engineering
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7 Food Technology
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Action WHEN YOU NEED IT FAST

BARNES & REINECKE

INDUSTRIAL DESIGNERS & ENGINEERS
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STAFF OF 181 TWELFTH YEAR

BETTER MOLDING . . . at a saving!

● Metasap Stearates help meet the demand for better lubrication needed by today's plastics industry with its intricate mold design and greater precision in the manufacture of molded articles Metasap products permit operations at lower pressures —they penetrate to the surface of the compound to give a clean-cut finish—they eliminate the need of after-treatments involving buffing operations. Result—improved internal lubrication and a clearer molding job at worth-while savings. For complete information write,

METASAP CHEMICAL COMPANY, HARRISON, N. J.
CHICAGO • BOSTON • RICHMOND, CALIF • CEDARTOWN, GA.
A Division of National Oil Products Company

METASAP CHEMICAL COMPANY

Stearates
REG. U.S. PAT. OFF. of Aluminum · Calcium · Lead · Zinc

In The Nude . . .

Frequently a molder or manufacturer says to us, in substance: "Here is our product, in the nude. Dress it up for us."

We put your idea through the lab. Then it is subjected to a great deal of critical attention before you see the finished product.

Transforming naked plastic, just off the press, into salable, attractive merchandise, is a welcome task we know well.

Challenge us to improve your product. You'll be the winner.

★ ★ ★

We offer a complete finishing service: Fabricating, silk screen printing, spraying, drilling, tapping, trimming, buffing, assembling, etc.

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Plastic Finishing CORPORATION
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HOPP Plastics

EXTRUSION MOLDING: Continuous lengths, in any form, cut to any length.

INJECTION MOLDING: Small to medium sized objects molded to any desired shape to meet your specifications.

LAMINATING with layers of transparent plastics to hermetically seal printed surfaces against moisture, oil and water.

FABRICATING: Wide variety of sheets, flexible or rigid, dull or glossy finish. Wide color range.

DIE CUTTING to any shape desired, done right on our premises.

PRINTING: We specialize in printing where extremely close register is imperative.

FORMING OF Sheet Plastics to any desired shape.

Write for Free Booklet
"Hopp Plastics Today and Tomorrow"

EXTRUSION MOLDING
INJECTION MOLDING
LAMINATING
FABRICATING
DIE CUTTING
PRINTING
FORMING

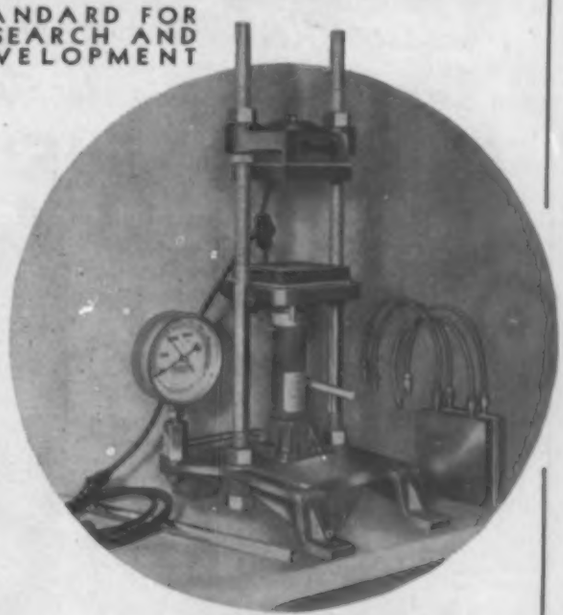
THE HOPP PRESS
INCORPORATED
460 W. 34th ST., NEW YORK 1, N. Y.
ESTABLISHED 1893

ELECTRIC HEATING EQUIPMENT
FOR THE PLASTICS INDUSTRY

HINGED TYPE BAND UNITS (illustrated) for all injection moulding machines; Size and Wattage to your specifications. Also space, strip, cartridge and immersion heaters—for the industry. We manufacture hot plates and ovens as well. Send us your heating problems.

GLENN ELECTRIC HEATER CO.
239-241 Canal Street New York 13, N. Y.

THE CARVER LABORATORY PRESS
STANDARD FOR RESEARCH AND DEVELOPMENT



Known thruout the Plastics Industry by its Characteristic Design

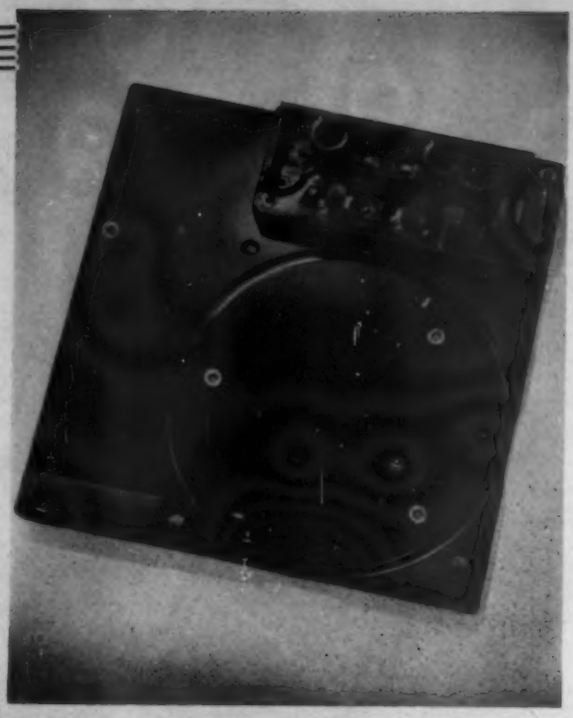
FRED S. CARVER
HYDRAULIC EQUIPMENT
343 HUDSON ST. NEW YORK 14

BIG JOB

This is a large molding no matter how you look at it. The outside circumference is nearly 36". It contains 13 inserts and it is molded complete with 23 holes of varying diameters. It is the back board for an automatic alarm and is an excellent example of the large sized jobs in Insulation-molded plastics.

Insulation is the acknowledged master of electrical-resistant plastic materials. We mold them in every conceivable size and shape for all industries, especially Telegraph and Telephone Companies and Radio stations.

We do our work on a custom basis, fulfill the most rigid specifications. We also offer a wide range of stock molded items such as Safety Strain insulators, terminal blocks and X-ray tube shields.



INSULATION MANUFACTURING CO.

Custom Molders of Plastics for Industry

11 NEW YORK AVENUE • BROOKLYN, N. Y.

Before Specifying a High Pressure Reducing Valve, be sure to Investigate This

ATLAS Type "E"

You will find that it is now being used in most if not all of the leading plastics plants. Why is it so popular? Because, without the slightest shock, it reduces pressures as high as 6,000 lb. per sq. in.—oil, water, or air.

Is it Different?

Yes, *all* regulating valves by ATLAS are *different* in that they are *better*. Type "E" for instance, is superior in every detail: The body is of forged steel. Internal metal parts are entirely of stainless steel. A formed packing of special material superior to leather is used which is immune to all fluids commonly used in hydraulic machinery. The pressure on the seat is balanced by a piston with the result that variations in high initial pressure have little effect on the reduced pressure.

Ask for complete information.

For other ATLAS plastics plant products see the partial list in our ad in the January 1946 issue of MODERN PLASTICS

ATLAS VALVE COMPANY

REGULATING VALVES FOR EVERY SERVICE

277 South Street, Newark 5, N. J.

Representatives in principal Cities

BELIEVE IN SIGNS?

When off colors, soft centers and warped pieces come out of the molds, it's a pretty sure sign that molding temperatures are off . . . somebody has guessed wrong. But why guess and spoil good powder? You can accurately, quickly and conveniently check the surface temperature of every mold cavity with the Cambridge Mold Pyrometer. Write for descriptive bulletin.

Combination and single purpose instruments

Cambridge Instrument Co., Inc.

3711 Grand Central Terminal, New York 17, N. Y.

CAMBRIDGE

Mold ★ Surface ★ Needle

PYROMETERS

Bulletin 194-S gives details of these instruments. They help save money and make better plastics.

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IN YOUR PLANS

To American business men this Bank will gladly forward information regarding locations for plants, branch offices or agencies throughout Canada. Our thorough knowledge of taxes, duties and procedures peculiar to Canada is at your disposal. Address enquiries to:

THE BANK OF TORONTO
Incorporated 1855
Head Office — Toronto, Canada

Pearl Essence

Special types have been developed for use with

Cellulose Esters (Acetate, Butyrate)
Cellulose Ethers (Ethyl Cellulose)
Vinylites (All types)
Acrylates (Lucite, Plexiglas)
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•

MEARLMAID PEARL ESSENCE

THE MEARL CORPORATION
163 Waverly Place New York, N.Y.

plastics

RIGHT — — —
FOR YOUR PRODUCTS

Which is the best plastics compound for your product? Must it resist heat . . . cold . . . moisture . . . friction . . . weather? Must it be strong? Is its use electrical?

Which is the best molding method? Compression? Transfer? Injection?

Church offers you the right answers. The right compound, plastic or rubber . . . the right molding method . . . the right mold- and product-design . . . the finished product that is RIGHT for YOU.

Church offers you this *complete* service — backed by years of experience . . . top-flight technical ability . . . facilities to *produce* . . . full financial responsibility.

Write for "Plastics by Church," a 24-page brochure illustrated in full color.

CFC
THE CHURCH MOLD MARK OF QUALITY

C. F. CHURCH MANUFACTURING COMPANY
HOLYOKE MASSACHUSETTS
Division of American Radiator & Standard Sanitary Corporation

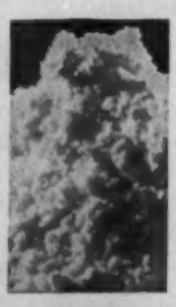
by Church

Tack this memo to your engineer's planning board

"RAYCOLITE" macerated resin-impregnated fabric is a phenolic molding compound of great possibilities for economy. Its application is limited to certain types of items, but where it is applicable the savings are extremely important.

Ample Working Sample Furnished

RAYCO COTTON FILLERS



FILFLOC	Pure cotton flock of surpassing cleanliness and uniformity.
FABRIFIL	Macerated cotton fabric for extra strength.
CORDFIL	Evenly cut lengths of tire cord for plastics of utmost strength.

RAYCO
Fillers

RAYON PROCESSING CO. of R.I. INC.

Developers and Producers of Cotton Fillers for Plastics

60 Tremont Street, Central Falls, Rhode Island

ORGANIC PEROXIDES

CATALYSTS FOR POLYMERIZATIONS
DRYING ACCELERATORS · OXIDATION AGENTS · BLEACHING AGENTS

LUCIDOL*
(BENZOYL PEROXIDE)

LUPERCO*
(PEROXIDE COMPOUNDS)

ALPEROX* C
(TECHNICAL LAUROYL PEROXIDE)

LUPEROX*
(PEROXIDE PASTES)

Special Organic Peroxides

* REGISTERED TRADEMARK

LUCIDOL CORPORATION

BUFFALO (5) N. Y.

PLASTIC MOLDS

25 years experience in designing and building molds for leading molders.

Our plant is modern in equipment for producing the best in molds. Compression, Injection, Transfer.

SOCIETY OF THE PLASTICS INDUSTRY · SPI

FORTNEY MFG. CO.

247 N.J. R.R. Ave.
NEWARK 5, N. J.

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WITH BLODGETT OVENS

One of four No. 158 Blodgett Gas-Fired Ovens used by E. I. Cournand and Co., 3835 9th Ave., New York, Manufacturers of Methyl Methacrylate products.

The No. 158 Blodgett Gas-Fired Oven shown at left is an ideal preform heater for small plastic parts. Use of this equipment in each forming department saves time, plant travel and operating cost.

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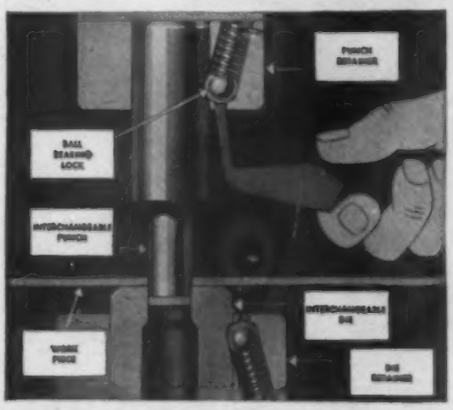

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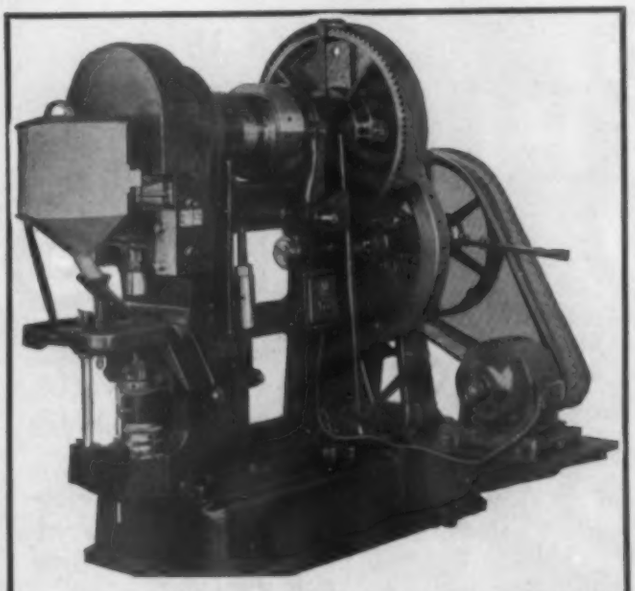

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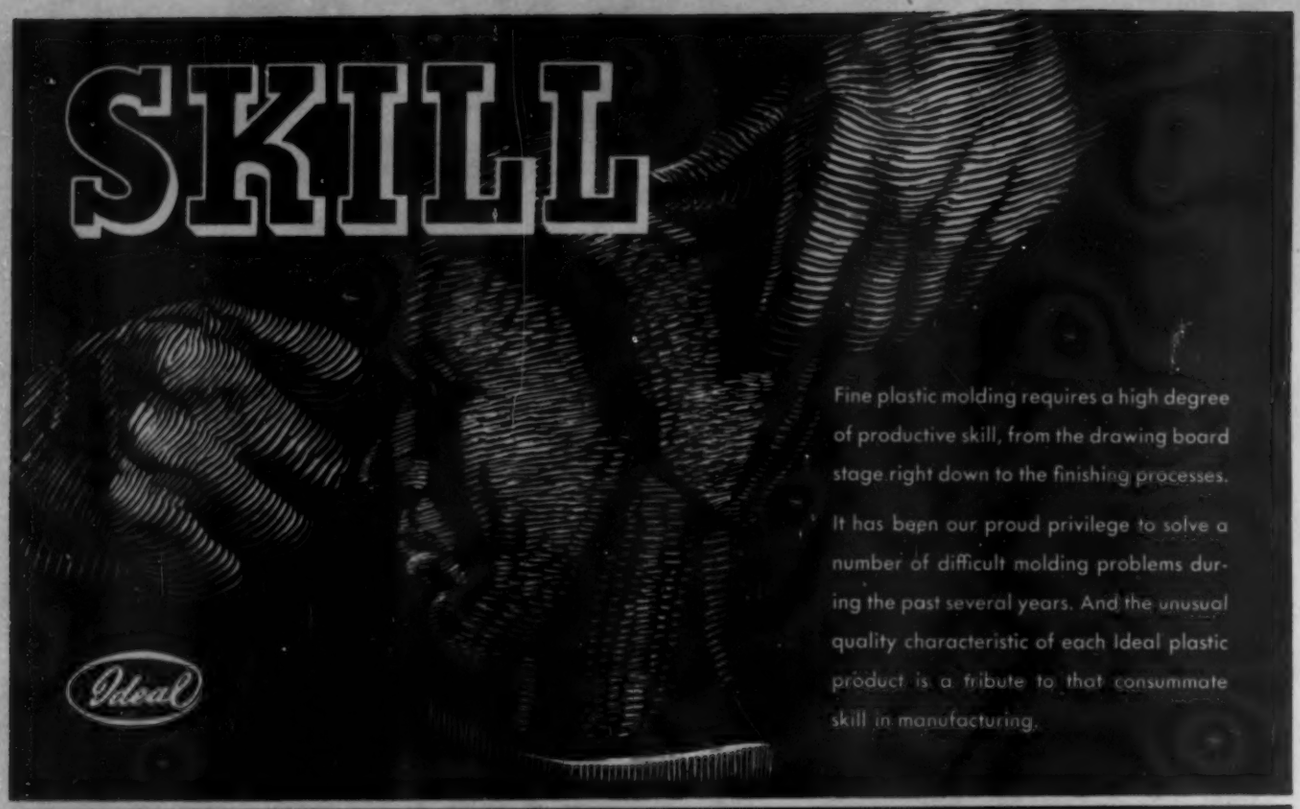

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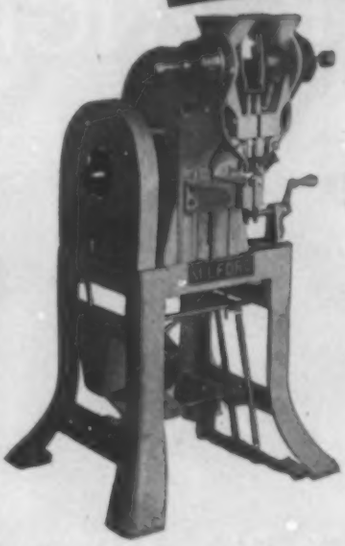

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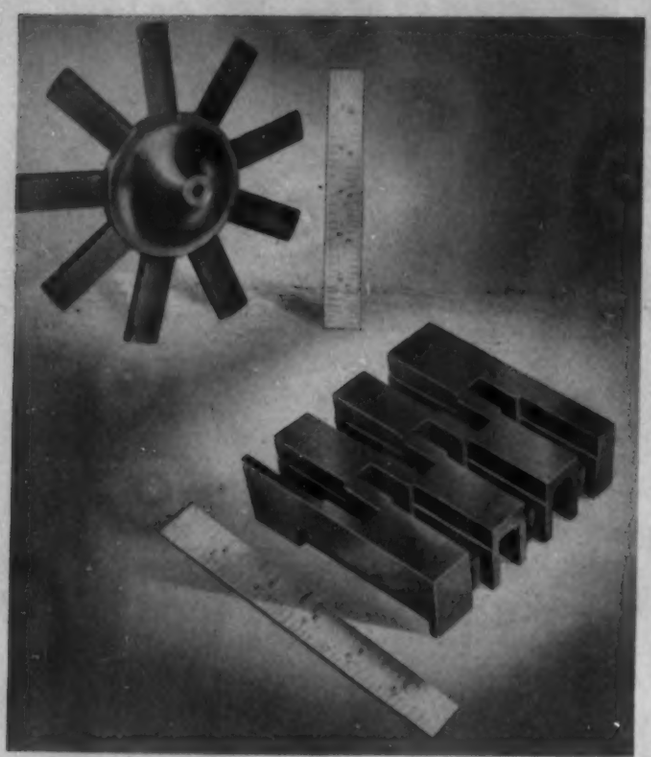

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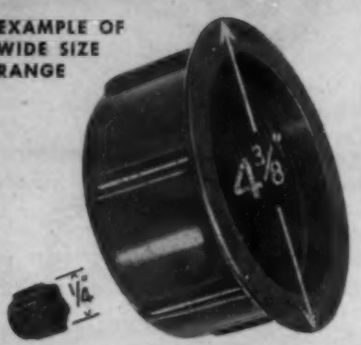

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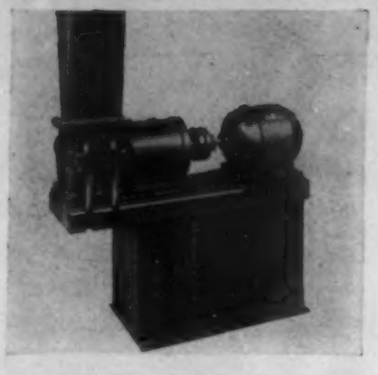

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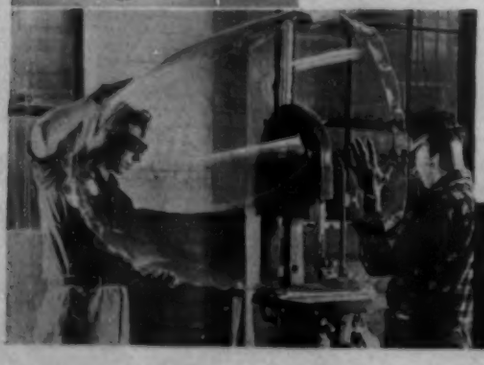

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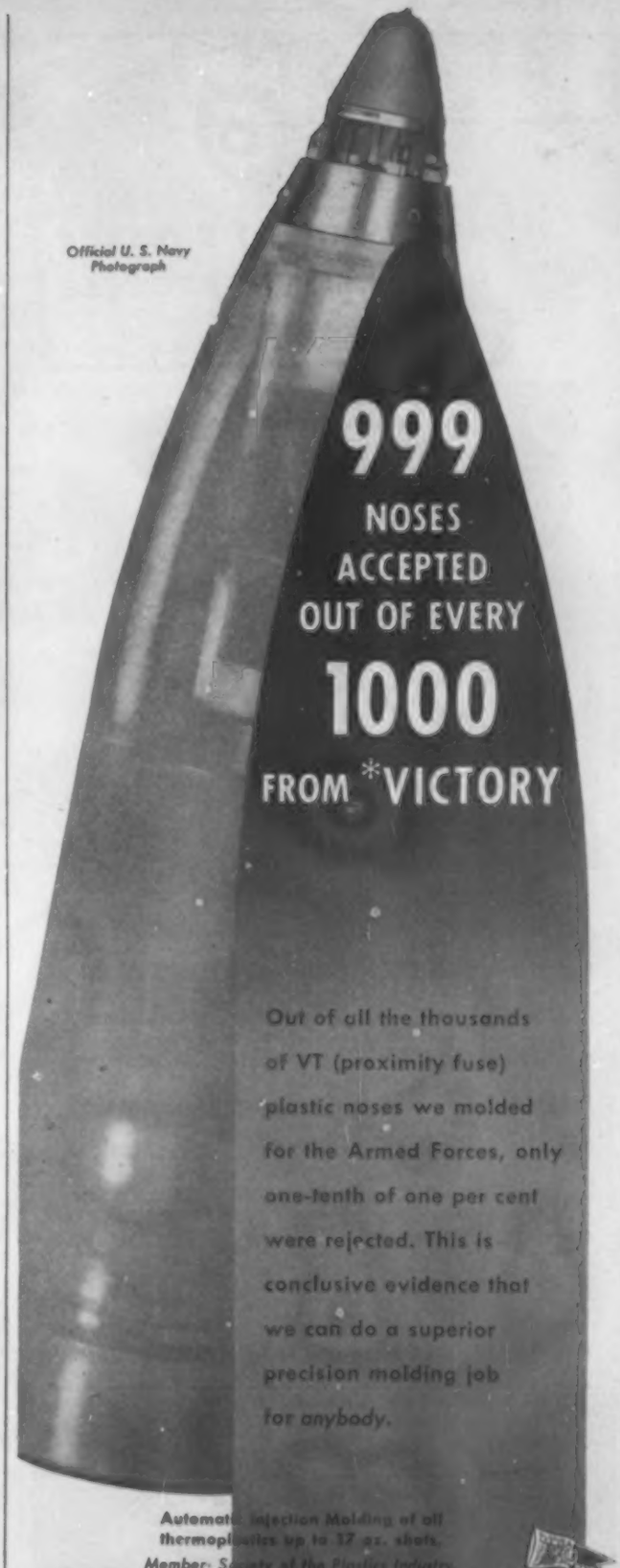
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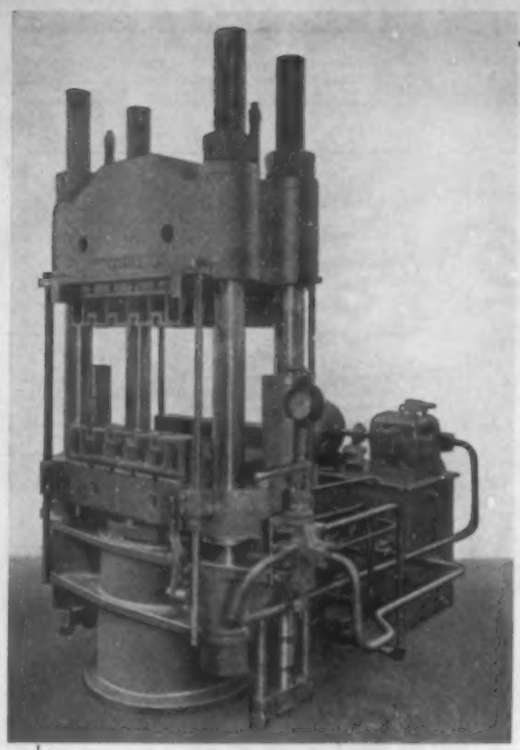

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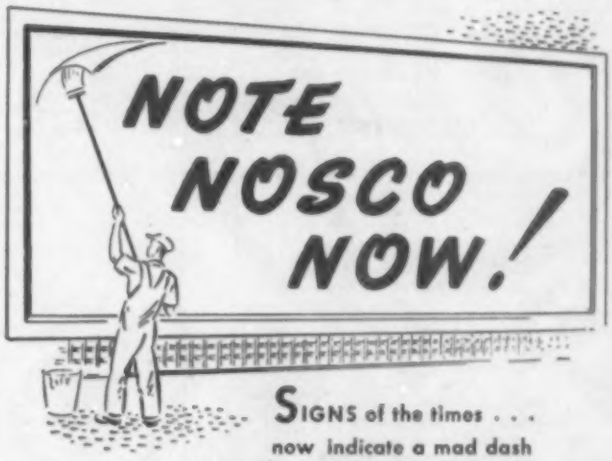


SIGNS of the times . . . now indicate a mad dash toward production of peace time products.

Where the use of Plastics is considered in your program, you will want to be sure it fits and has sales appeal . . . what's more important that it will work.

For Planned Plastics make a note now . . . to KNOW NOSCO.

This Modern Plant built by and devoted to Quality molding of Plastics. Nosco can help you. Write Today.

NOSCO Plastics

DIVISION OF NATIONAL ORGAN SUPPLY CO. • ERIE, PA.

All classified advertising payable in advance of publication. Minimum, $5.00 (up to 40 words); in border, $10.00 per inch.

Classified Advertisements

For further information address Classified Advertising Dept. MODERN PLASTICS 122 East 42nd St., New York 17, N. Y.

WANTED: THERMOPLASTIC SCRAP or rejects in any form, including Acetate, Butyrate, Styrene, Acrylic and Vinyl Resin material. Submit samples and details of quantities, grades and color for our quotations. Reply Box 508, Modern Plastics.

WANTED: Small or medium sized plastic molding plant with either hydraulic extrusion or injection equipment with or without tool shop. Advise full details. Reply Box 788, Modern Plastics.

FOR SALE: 1—500 ton Hydraulic Press with downward moving ram and pushbacks. Box 512, Modern Plastics.

SPENCE-RIGOLO
PRODUCT DESIGN & STYLING
677 Fifth Ave., New York 22, N. Y.

DO YOU NEED a Hydraulic Press for Compression Molding, Transfer Molding, Laminating, Forming, Bending and Hobbing? Whatever it may be, if it is hydraulic, see Sal-Press Company, 388 Warren Street, Brooklyn, N. Y. Specializing in rebuilding of new, and used hydraulic equipment.

WANTED: PLASTIC SCRAP OR REJECTS in any form. Cellulose Acetate, Butyrate, Polystyrene, Acrylic, Vinyl Resin, etc. Also wanted surplus lots of phenolic and urea molding materials. Custom grinding and magnetizing. Reply Box 318, Modern Plastics.

FOR SALE—1—French Oil Hydropneumatic Accumulator; 1 Worthington Hyd. Pump 1 x 6, 5 GPM 6000 pressure M. D. 1—14" x 24" Press, 9" ram; 4—24" x 55" steel cord Heating Platens; 4—W. & P. Mixers; 1—Thropp 10 x 24" Rubber Mill, 1—8 x 13" Rubber Mill; 1—set of 18 x 50" Compounding rolls, reduction gear and motor; 1—Stokes Rotary 32 punch Preform Press; 6—Hydraulic Presses, 20 x 20", 12 x 14"; Allen 6" Tuber; Dry Powder Mixers; Pulverizers, Grinders, etc. Send for complete list. Reply Box 1310, Modern Plastics.

IN THE MARKET FOR: Stainless Steel or Nickel Kettles, Vacuum Pan, Preform Machine and Mixer, Hydraulic Presses. Reply Box 825, Modern Plastics.

PLASTIC CONSULTANT
Earlier Director of Research with the E. I. du Pont Co., at Arlington, N. J., later Director of Research with the Fiberloid Co. (Monsanto Chemical Co.) at Springfield, Mass. Recently with the Plastics Branch of the War Production Board.
My services are now available as a consultant in plastics and color.
ELBERT A. WILSON, Quarryville, R.F.D. #1, Pennsylvania

ATTENTION INJECTION MOULDER
Capable Sales Organization with 22 years successful merchandising experience will discuss production and distribution with MOULDER HAVING FACILITIES for large volume production of various items. We sell chain, department, variety stores, jobbers also industrials coast to coast. Will make investment for expansion or finance sales or work on commission basis. N. Y. C. office-showroom. Reply Box 1442, Modern Plastics.

WANTED: Experienced plastic moulder to take charge of small plastic department and develop it. Good opportunity! Reply Box 1444, Modern Plastics.

CHICAGO REPRESENTATION
Established Chicago distributor desires several part-time exclusive established lines for Chicago territory; commission or resale; or special sale assignments or follow-up work. Local representation and address for nominal charge, sales and service. Reply Box 1443, Modern Plastics.

WANTED
NEW CHEMICAL PRODUCTS
Intermediates or compounds selling to industrial and commercial markets. Our client established 30 years, manufactures to standards of highest quality. Please write. Communications confidential. We are fully compensated by our client.

CHARLES H. WELLING & CO., INC.
52 Vanderbilt Avenue
New York 17, N. Y.
New Products—New Processes

WANTED: Extruder or fabricator to assist in establishing a plant. Applicant must have thorough knowledge and experience in one of these fields. Attractive proposition for right person. Write details. Reply Box 1445, Modern Plastics.

EXPORT AGENT
Very experienced, showroom Fifth Avenue, large following of N. Y. export accounts; interested in representation of manufacturers in various plastic items; commission basis. All payments made in U. S. currency in N. Y. Reply Box 1446, Modern Plastics.

FACTORY PRODUCTION MANAGER WANTED
Must have thorough experience, preferably handling varied types of production. Age 35 to 45. Good personality, diplomatic but with plenty of *push*. Plant located in small town near good central Ohio city. Company makes a number of well-known consumer and commercial products. Rated AAA-1. Good salary. Excellent future. Write giving complete experience and education. Reply Box 1447, Modern Plastics.

FOR SALE—2 sets bakelite molds, 80 cavities each, 27 millimeters, 4 steam plates 2 ft. sq., 2 air drills, 1 Studebaker Hydraulic Press with 20 Ton gauge. Approximately 3,000,000 pulp wood and empervite linners, size 1.031" diameter, .050" thick. SUN KRAFT, Inc., 215-17 W. Superior St., Chicago 10, Ill.

INJECTION MOLDING
Chicago Molder will have open time on 8-9 ounce machines beginning March 1946. Prefer jobs already tooled but can start tooling on new jobs immediately. Here's your chance to get quick deliveries now and also on future orders. Reply Box 1448, Modern Plastics.

FOR SALE: Colton #2 and Stokes "B" Rotary Tablet Machines; Heavy Duty Single Punch Press for preforms such as handled on a Stokes R or Colton #5½ Tablet Machine; B & B 200 Ton Hydraulic Press 13" Ram with Hydraulic Pump; Ball & Jewell #2 Rotary Cutter. MACHINERY & EQUIPMENT CORPORATION (of N. Y.), 533 West Broadway, New York 12, N. Y. GRamercy 5-6680.

EXCELLENT OPPORTUNITY for experienced extruder in high-finish vinyls and acetates with progressive company. Now in process of increasing equipment and extending operating hours. Some tool room experience desirable but not essential. Location New York City. Our employees advised of this advertisement. Reply Box 1449, Modern Plastics.

WANTED—Manufacturers, representatives, for injection molded plastics and large fiber plastics for distribution throughout the United States. Capacity for injection molding now available. Will finance molds of promising products. Write Box 231, Barberton, Ohio.

SALES ENGINEER WANTED—Prefer young man with thorough knowledge of mold-making and mold design. Excellent opportunity with progressive company in plastics industry. Reply Box 1450 Modern Plastics.

WANTED FOR ARGENTINA AND URUGUAY—Manager of Dionisi and Co. in Buenos Aires now in N. Y. wishes to represent manufacturers of cellulose acetate, urea, polystyrene, methacrylate, vinyls, and other plastics materials. Also interested in molded products, novelties, plastic handbag frames and accessories, household appliances, and other plastic products with good sales possibilities. Machines for plastics industry required. C. A. Weiss, 203 West 81st Street, N. Y. C.

FOR SALE. One three-year old 15 kw RCA high frequency dielectric heater complete. Very good condition. Has never been used to more than one-third of its capacity. Reply Box 1451, Modern Plastics.

WE HAVE AN OPENING in our organization for a man thoroughly experienced in Processing for Thermoplastic materials preferably one who has had experience in actual production in extrusion and injection moulding. Should also have some knowledge of compounding. Wonderful opportunity, excellent working conditions for right party. Give complete details in first letter. All replies confidential. Reply Box 1452, Modern Plastics.

PLASTICS ENGINEER, 32, B.S. Chemistry. 5 years diversified experience in all phases of plastics industry. Specialized in design, testing fabrication of low pressure laminated parts. Desires responsible position with progressive company. Will locate anywhere in U. S. or South America. Presently employed. Reply Box 1453, Modern Plastics.

PLASTICS MOLD DESIGNERS and other plastics specialists wanted to assume high-salaried key instruction positions. Send picture and qualifications to Plastics Tech, 5200 Euclid Avenue, Cleveland 3, Ohio.

WANTED: Used machinery and equipment for compression, injection and extrusion molding. Or small plant ready for operation. Description and prices to Box 1454, Modern Plastics.

WANTED
INDUSTRIAL DESIGNER
By large New York firm. Wide experience, top ability, mature, capable of handling important contracts and clients. Salary high. Opportunity permanent. Reply Box 1455, Modern Plastics.

FAST GROWING West Coast selling organization with crew of over 100 go-getters calling on homes desires to add fast selling plastic items of merit. Will finance. Reply Box 1456, Modern Plastics.

WANTED: One 22 x 22 x 60" rubber mill with drive, motor and controls for 60 cycle 3 phase 440 v. current. Apron belt attachment also desirable. Please state price, location and complete description. Reply Box 1457, Modern Plastics.

PLASTIC ENGINEER WANTED—We have coating machines and want someone who is familiar with plastic coating operations on paper. East Coast Paper Products Corp., 90 Butler Street, Brooklyn 2, N. Y.

WANTED: PROBLEMS. Relating to use of new materials; better design for lower cost; improvement of equipment and methods; laminations, extrusion, die economy. Marketing and policy. Interesting worth while questions only. Years of manufacturing experience along these lines. Reply Box 1458, Modern Plastics.

Let This Leading Distributor Sell Your Products Through Music Stores — Coast-to-Coast

Do you ever stop to think about what's going to happen to your sales when the buying rush is over?

Almost any product will sell today. And almost any kind of distribution method will sell in today's frenzied buying rush.

But someday, mister, you and your dealers or distributors are going to have to go back to selling instead of merely delivering. A little serious thinking about your sales setup now will save you a lot of dollars then.

A Plan That Bears Investigation

Whether you have already distributed successfully in the music field or not, our organization and our method of operation will be worth investigating.

We are a nation-wide musical merchandise distributor. Our service to the music stores of this country dates back before the last war. We've been all through this "post-war" selling experience before.

We do business with most of the leading music stores of this country. They have confidence in us.

Our policies are respected throughout the industry. Our promotion methods have been frequently called outstanding in this field. We operate on a one-price policy and we sell only through retailers.

Furthermore, our selling method and organization are unique. And, we are probably the only distributor of musical merchandise whose name is known generally to musicians, because of many years' advertising in professional journals.

What We Could Do For Your Product

Let's assume that your product is one that can be sold through music stores —that it has merit—and that it is priced in accordance with its quality. Whether or not you are now selling in the music field makes no difference.

Here's what we can do for your product:

—within five days after receiving delivery promises and your approval, we can present your product to virtually every music store in the United States.

—we can assure you of continuous product promotion to dealers——promotion of a calibre that will sell long after the buyers' rush is over—promotion that was proved in the acid test of the depression and in the prewar days of real competition.

—providing you deliver to us, dealers' orders for your product will be shipped within 24 hours after receipt.

—dealers will know in advance that if for any reason they are dissatisfied with your product, their right to return it to us will not be questioned; that adjustments of all kinds such as usually arise in commercial relationships will be made promptly and courteously.

—you can sell to us in quantity—get your cash immediately if desired—get firm commitments in advance and serve one large account instead of many small ones.

—you can profit from the good will of our name, which may be better known in the music field than yours.

Some of the Lines We're Interested In

Plastic Specialties
Band Instruments
String Instruments
Electronic Instruments
Musical Supplies
Instrument Accessories
Phonographs and Accessories
Radios
Amplifiers
Music Boxes
Instrument Cases
Piano Accessories
Musical Novelties

—anything that can be sold through music stores *except publications.*

NOTE:

We have several completely designed products for which we are seeking manufacturers (metal and plastic).

If You Are Now Selling Direct to Dealers

Maybe you sold through distributors before the war and became dissatisfied. Maybe you've just started to sell in the music field. At any rate, you may have decided that you'll sell direct to dealers and "take the extra profit."

We believe that we can prove to you, in a half an hour, that it will pay both you and the retailer to have your distribution handled by us because:

—your product will be "exposed" to more dealers by our organization than by yours;

—your credit problems are eliminated (we already know the credit standing of virtually every retailer in the field);

—handling in your plant is simplified—correspondence is reduced—you can concentrate on manufacturing;

—another phase of our unique plan advertises your product to consumers and supplements your own advertising program;

—you can feel free to call on us for assistance in product design, packaging, and advertising—or, if you like, we can handle this for you entirely and relieve you of all selling details.

—selling costs are high today, but because of our volume we believe you can distribute less expensively through us than you can direct.

This is not an embryonic idea. It is a living, working plan. We can give you dollars and cents stories of products that we have "put over" for other manufacturers.

Why Do We Want Lines?

We already have some of the top lines in the industry. Some of our lines have been with us for years. Most of these suppliers are doing a swell job for us. Why do we want more lines?

Because we are preparing for the greatest sales program in our history.

During the war we did a whale of a job—expanded our manufacturing facilities—built up our personnel—increased sales.

Now we want to hold as much of that volume as possible. So we are getting under way on a long-range selling-advertising-promotion plan that will not only maintain our position among the leaders of the industry but will actually expand that position.

Do This Today!

Drop a line to us at the address below. We'll do the rest. We'll place a responsible executive of our firm in touch with you to discuss the matter—lay our cards on the table—and let you decide the advantages of doing business through us.

If you already have some distributors, don't let this stop you—probably a plan can be worked out that will not interfere with your present commitments.

Negotiations will be on a confidential basis if you say so. We'll supply first class credit references.

Furthermore, if you do not care to open up correspondence with a "blind" address, just get in touch with the editor of this magazine, tell him you are interested in selling us, and he will tell you who we are.

Fair enough? Let us hear from you.

"DISTRIBUTOR"

BOX OA1466
MODERN PLASTICS

Actual Statements From Music Dealers About Our Organization

(Originals In Our Files)

"I think you people have the finest method of doing business that I have so far come in contact with." (New York dealer)

"We do appreciate the excellent service you have personally given us." (Washington dealer)

"Of course, most of the credit must go to your wide awake organization, which imbued us with the necessary pep to go out and 'mow 'em down.'" (Tennessee dealer)

"By the way, speaking of service, you have the best." (Kentucky dealer)

"It is indeed a pleasure to find at least one firm that is really trying to give the legitimate dealer a break." (Connecticut dealer)

"I think your service is the best in the country and also the most courteous and 'cleverest.'" (Minnesota dealer)

"It is a pleasure to do business with a house that thinks up all the things you do to help the dealer." (Illinois dealer)

"We have never seen anyone nicer to do business with." (Texas dealer)

PAPER TRANSPARENTIZER

Technical man experienced in transparentizing paper. Ability to work with research chemists and design or assist in the design of equipment for transparentizing papers. Experience more important than age. Give complete information in first letter, including salary requirements. All answers held confidential. Reply Box 1400, Modern Plastics.

WANTED: One flying shear with or without electric motor, motor controls and drive and with or without conveyor belt. Please state price, location and complete description. Reply Box 1459, Modern Plastics.

FOR SALE: Plexiglas scrap pieces in various sizes. 2 thousand pounds. No shipment under 100 lbs. Reply Box 1460, Modern Plastics.

WANTED—FOREMAN OF EXTRUSION DEPARTMENT

Complete knowledge of extrusion methods and die design for rigid and non-rigid materials. Location New York City. Excellent opportunity for right man. Write fully giving experience, age and salary expected. Box 244, Suite 617, 1457 Broadway, N. Y. C.

WANTED—A PRODUCT OR A BUSINESS

A leading precision tool manufacturer wants to acquire manufacturing and selling rights for one or more industrial or consumers' goods products having potentially large unit sales. Product should be rapidly perishable, or it may be durable although requiring a replaceable perishable accessory. Consideration will be given to purchase of business and factory if necessary. Reply Box 1461, Modern Plastics.

WANTED: 24" x 60" two roll mill. Ratio 1½-1. Also 6" x 12" laboratory mill. Reply Box 1462, Modern Plastics.

FOR SALE: Hydraulic Presses: 600 ton Watson Stillman double acting downward ram, platen 24" x 24"; 2—self-container, completely automatic 3 tons capacity; 3—20" x 20" 10" rams, 75 tons; 1—24" x 24" 6" ram, 75 tons; 1—24" x 24" 10" ram; 2—24" x 24" 16" rams, 250 tons; 1—24" x 30" 16" ram, 250 tons; 1—30" x 30" 16" ram, 5 openings, 250 tons; 1—30" x 20" 13" ram, 150 tons; 1—26" x 53" 14" ram, 400 tons; 1—20" x 40" 2—8" dia. rams, 100 tons; 4—12" x 12" 7½" rams, 50 tons; 1—12" x 12" 7½" ram, 75 tons; 2—15" x 15" 8" rams, 75 tons. Pumps: 1—HPM Triplex 1½ GPM 2500#; 1—4 plunger 6 GPM 2000#; 1—Robertson Duplex 1½ GPM 4000#; 1—Watson Stillman 4 plunger box type 2 GPM 4400#; 1—HPM Triplex 1½ GPM 2000# on high, 16 GPM 400# on low, V Belt Pulley; 1—Hele Shaw JLP 12, 44 GPM 1200# with new control; 2—Vickers Units 27 GPM 1000#; 1—Gould Triplex 12 GPM 1250#; 1—Elmes Duplex 1.5 GPM 2250#; 1 Watson Stillman single plunger ⅜ GPM 4300#; 4—Stokes 1¼" dia. tabletting machines; Accumulators: 1—Watson Stillman hydropneumatic type 1.86 GPS 5500# pressure with by-pass valve; 1—Buckeye high and low pressure tank type, 3½ GPS 4000# and 20 GPS 500#; Extruder; Housatonic 6" Extruder; Mills; Calenders, Mixers, Laboratory Presses, etc. HIGHEST PRICES PAID FOR YOUR USED EQUIPMENT. Universal Hydraulic Machinery Company, 285 Hudson Street, New York City 13.

INJECTION MOLDING. We have open time and materials on 4 ounce and 8 ounce injection machines if you have the molds. Harry O. Sandberg, 580 Commonwealth Ave., Boston, Mass.

WANTED—REPRESENTATIVES, calling on electrical, radio, appliance and other manufacturing companies, who can obtain orders for small compression parts. Chicago molder has unusual set up for quality work on small items, at competitive price. Reply Box 1463, Modern Plastics.

WANTED: MOLDING DEPARTMENT FOREMAN, must have complete knowledge of molding technique and equipment, supervisory ability. Permanent position with a future. Reply giving details as to background and past experience. Reply Box 1464, Modern Plastics.

FOR SALE: HPM 600 Ton Mold. Presses 42" x 48"; D & B 500 Ton 42" x 48"; D & B 250 Ton 42" x 42"; Farrel Birm 150 Ton; also 20 to 250 Tons from 36" x 36" to 12" x 12"; 40 Ton Broaching Press; 400 Ton Extrus. Pr.; W. S. Hor. 4 Plgr. 1" x 2" x 4", H & L Pressure Pumps; W. S. 1¾" x 12" hor. 4 Plgr. 30 GPM. 3500 lbs.; H.P.M. 1½" x 6" Vert. Triplex, 10 GPM, 2700 lbs.; 2—Oilgear Pumps, 13 GPM 1250 lbs.; Wat.-Farrel 1¼" x 4" vert. triplex, 6 GPM 3000 lbs.; Elmes 1" x 4" & 1½ x 4" hor. 4 plgr., 5 to 8 GPM, 4500 lbs. & 5500 lbs. Rumsey 4½" x 8" vert. triplex, 65 GPM, 900 lbs.; Elmes 2½" x 4" hor. 2 plgr., 17 GPM, 850 lbs.; 10 HP horiz. 1¼" x 4" triplex 6 GPM, 3000 lbs.; New Vickers 1¼" Oil Relief Valves; New Vickers ¾" Flow Control Valves; 2 Adamson 6" extruders; Hyd. Steam Pumps; Hand Pumps; Low Pressure Pumps 150 to 600 lbs.; Hydr. Accum., Heavy Duty Mixers; Roller Conveyor, Grinders, Pulverizers, Gas Boilers, etc. PARTIAL LISTING. WE BUY YOUR USED MACHINERY. STEIN EQUIPMENT CO. 426 BROOME ST., NEW YORK 13, N. Y. CANAL 6-8147.

WANTED—EXTRUDED PLASTICS SUPERVISOR. Graduate Mechanical or Chemical Engineer Familiar with all Thermoplastics. To Assume Complete Supervision of Present Extrusion Molding Plant in Chicago. Practical Experience in the Technique of Extruded Plastics Preferred. Excellent Future Assured Qualified Applicant. Replies Kept in Strictest Confidence. Salary Open. Reply Box 1465, Modern Plastics.

FOR SALE: Three used hydraulic oil presses, 200 ton capacity, 36" x 36", 12" ram, 36" stroke, 49" daylight. Price $1250. Eight new hydraulic Vane type pumps, 5 gallons per min., 2000# P. S. I. Sal-Press Company, 388 Warren Street, Brooklyn, N. Y.

AVAILABLE: Plastics man, 13 years in the business, 10 years molding foreman, 2 years general foreman of production, 1 year molding plant superintendent. Would like to contact company starting their own plastic department. References furnished. Prefer Midwest. Reply Box 1468, Modern Plastics.

WANTED: Molding room foreman—Experience in multicavity compression molding-setup mold—repairs—molding technique-polishing. Midwest location. Excellent opportunity right man. Write stating age, experience and salary expected. Reply Box 1352, Modern Plastics.

ASK YOURSELF FRANKLY "WILL IT PAY TO SELL MY BUSINESS?"

TODAY'S unusual industrial conditions may well justify you in turning your business—FOR CASH—to new management. As a reputable operating organization of long experience, with substantial capital, we can bring opportunity for increased company expansion and greater profit . . . while you are relieved of heavy expense and worry. Personnel held intact whenever possible. All discussions and negotiations strictly confidential.

Box 1230, 1474 B'way, N. Y.

SALES ENGINEER with decorative and industrial laminated experience and also veneering experience desires position in N. Y. Ret. veteran with N. Y. area contacts. Reply Box 1470, Modern Plastics.

POSITION WANTED: Plastics Production Engineer, age 24, Chemical Engineering degree, three years practical experience and training in tool room procedure, tool and product design, operation of injection and compression machines, molding and finishing procedure, estimating, and plant management. Capable of establishing and maintaining congenial relationship with customers. Reply Box 1471, Modern Plastics.

FOR SALE

1—Rodgers 2 plunger Oil Pump SGPM 3000#; 3—Vickers Oil Pumps 17 GPM 500 to 1000#; Metalwood Horizontal 4 plunger 1 GPM 3000#; 1—Rumsey Vertical Triplex 300 cubic inches 3000#; 2—Deane Worthington Triplex Pumps 400 cubic inches 4000#; 1—Gould Vertical Triplex 24 GPM 2500#; 1—Robertson Vertical Triplex Pump 7 GPM 5000#; 1—Robertson Vertical Triplex Pump 4 GPM 6500#; 2—Gould Vertical Triplex 200 GPM 500#; 1—Elmes Horizontal 4 plunger 6½ gallons 5000#; 2—Galland Henning Horizontal 4 plunger Pumps 50 GPM 2000#; 2—42 x 42" 14" ram presses; 30 ton Watson Stillman 12 x 12" Laboratory Presses; Hele Shaw variable pressure 23 GPM 2500#; Racine Pumps 30 GPM 1000#; Racine Boosters 3 to 1 ratio; W. S. Vertical 2 pl. pumps 176 cubic in. 6000#. Reply Box 1225, Modern Plastics.

MASTER MECHANIC WANTED

Plastics and Rubber molding concern—vicinity Trenton, N. J.—established 50 years, has opening for master mechanic with experience in rubber and/or plastics. In charge of force of 40 to 50 men in various service departments; machine shop, electrical, boiler plant, etc. And responsible for maintenance of plant and equipment. Expanding business offers excellent future. Write fully, giving age, experience and salary expected. REPLY Box 1469, Modern Plastics.

PLASTICS ENGINEER AVAILABLE. B.S. degree. Training chemistry, engineering, math, drafting, business management. Ten years experience in supervision, production, development, testing, design. Wide background in molding, laminating, casting, post-forming, low pressure, thermoplastic forming for electrical, mechanical and decorative use including aircraft and automobile parts. Knowledge entire plastics field. Consider responsible offers production, development, consulting, etc. Reply Box 1472, Modern Plastics.

PRODUCTION AND DEVELOPMENT MAN

to take charge of a department of our plant; must be thoroughly experienced and capable of designing dies, jigs and mandrels for low pressure moulding of curved plywood, Co-rolite fabric and paper, with Hydraulic press and Autoclave equipment. Must have the know-how of development and production. This is a nice job for a man who can fill it. Department now doing about $40,000 per month. We want to double it. Write fully about yourself. Reply Box 1473, Modern Plastics.

SPLENDID OPPORTUNITY

RESEARCH CHEMIST for process development work in field of synthetic resins and laminates. A splendid opportunity for chemist possessing a good knowledge of chemistry. Company substantial and progressive. Surroundings congenial. In writing give education, experience, age, and salary expected. Location Western New York. Correspondence confidential. Reply Box 1474, Modern Plastics.

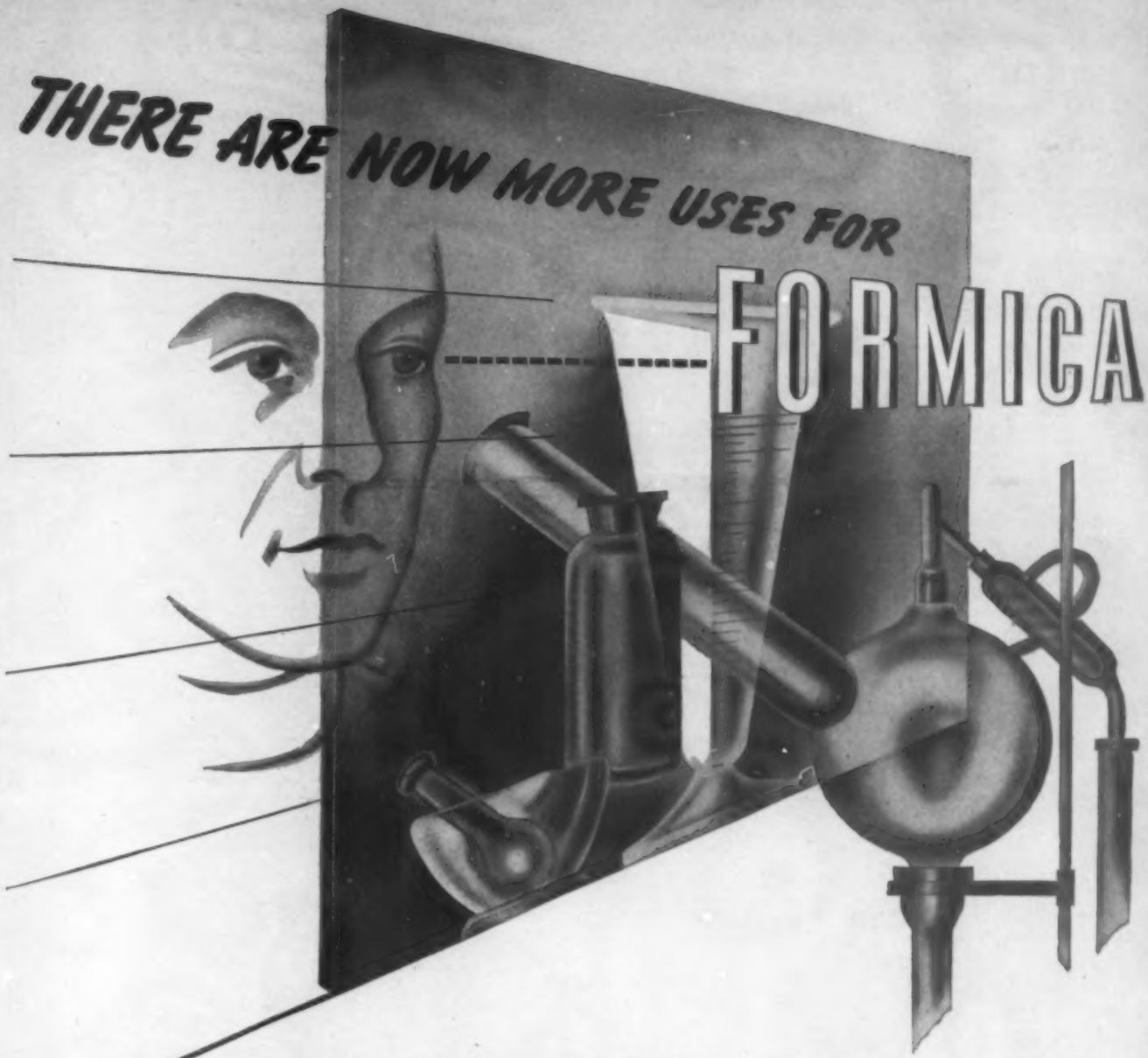
P. STEVENS BLANK

Industrial Designer

Specializing in Furniture and Decorative Articles

Mailing Address: 312 N. Spaulding Ave., Los Angeles 36, Cal.

THERE ARE NOW MORE USES FOR FORMICA



Because of what happened in laboratories during the war—our own laboratories and those of our suppliers—Formica is adapted to more uses now than ever before in its history. And it serves many of the old time uses much better and more efficiently than it has before.

New materials and new methods have improved the material as a high frequency insulator; its stability of dimensions and electrical characteristics under extremes of humidity have been stepped up; it can now be made immensely stronger and more resistant to mechanical strains than ever before; its resistance to both alkalies and acids has been improved for chemical uses.

Therefore, it follows that the material can now be used for many purposes for which it was not previously considered.

Engineering data on these new qualities and capabilities is available in the "Formica Data Book". Ask for it.

FORMICA

THE FORMICA INSULATION COMPANY

4673 Spring Grove Ave., Cincinnati 32, Ohio

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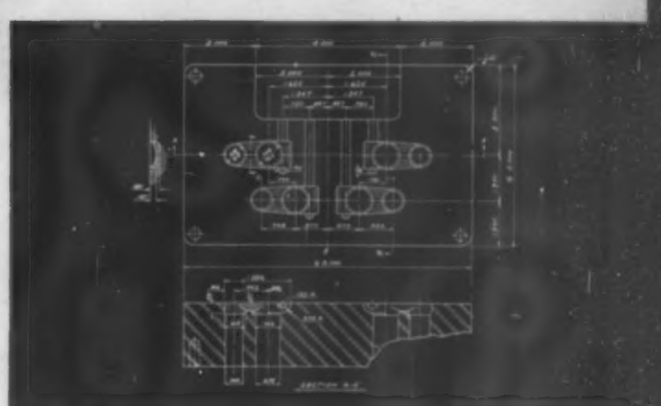

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